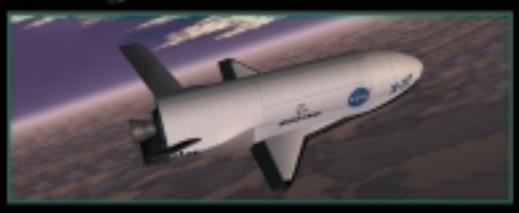
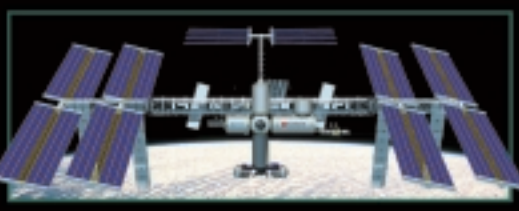


MARSHALL SPACE FLIGHT CENTER

FY 2001 IMPLEMENTATION PLAN



The NASA Vision

NASA is an investment in America's future. As explorers, pioneers, and innovators, we boldly expand frontiers in air and space to inspire and serve America and to benefit the quality of life on Earth.

NASA Mission Statement

- **To advance and communicate scientific knowledge and understanding of the Earth, the solar system, and the universe and use the environment of space for research;**
- **To advance human exploration, use, and development of space;**
- **To research, develop, verify, and transfer advanced aeronautics, space, and related**

The NASA Strategic Enterprise Goals

Human Exploration and Development of Space	Aerospace Technology	Space Science	Earth Science	Biological and Physical Research*
■ Expand the space frontier.	■ Global Civil Aviation Goal—Develop an environmentally friendly global air transportation system for the next century of unquestioned safety that improves the Nation's mobility.	■ Chart the evolution of the universe from origins to destiny, and understand its galaxies, stars, and life.	■ Expand scientific knowledge by characterizing the Earth system.	
■ Expand scientific knowledge.	■ Revolutionary Technology Leaps Goal —Revolutionize air travel and the way in which air and space vehicles are designed, built, and operated.	■ Contribute measurably to achieving the science, math, and technology education goals of our nation.	■ Disseminate information about the Earth system.	
■ Enable and establish a permanent and productive human presence in Earth orbit.	■ Space Transportation Goal—Achieve the full potential of space for all human endeavor through affordable space transportation.	■ Support human exploration through robotic missions.	■ Enable the productive use of Earth Science Enterprise science and technology in the public and private sectors.	
■ Expand the commercial development of space.	■ Research and Development Services Goal—Enable, and as appropriate provide, on a national basis, world-class aerospace R&D services, including facilities and expertise.	■ Develop new technologies needed to carry out innovative and less costly mission and research concepts.		
■ Share the experience and discovery of human space flight.				

*The requirements of the newly established Enterprise will be included in the next fiscal year's Agency Performance Plan and Center Implementation Plan.

MARSHALL VALUES

The Marshall Space Flight Center team is committed to these core values.

People

• We recognize that the people who work here are "most important"—and are our greatest strength. • We create a safe and healthy environment.• We encourage balance between personal and professional life. • We enable personal and professional growth.• We commit ourselves to the highest standards of integrity and ethical behavior.• We reward and celebrate our accomplishments.• We recognize individual and cultural differences and treat each other with dignity and respect.

Customers

• We are accountable to our customers and are committed to their satisfaction.
• Our customers can depend on us to deliver quality products and services.

Excellence

• We pursue excellence in our people and in everything we do.
• We promote continual learning and improvement.
• We hold one another accountable for doing what we commit to do.

Teamwork

• We are a unified and interdependent team.
• We cooperate, communicate openly and share ideas with each other for the common good.
• We seek and enable partnerships with other NASA Centers, other agencies, academia, industry and our local and global communities.

Innovation

• We promote innovation and creativity.
• We seek different ideas and perspectives.
• We are committed to making a significant difference.
• We are willing to accept well-assessed, selected risks in the pursuit of our goals—but never at the expense of safety.

These values serve as the principles that guide our decisions and behaviors.

SAFETY IS A FRAME OF MIND.

MARSHALL SPACE FLIGHT CENTER

MISSION

**Bringing people to space; bringing space to people.
We are world leaders in access to space and the use of space for research and development to benefit humanity.**

GOALS

- Establish MSFC as number one in safety within NASA.
- Develop and maintain NASA's pre-eminence in space propulsion, enabling the exploration and development of space while dramatically increasing program and mission safety and reliability and reducing overall cost.
- Lead the research and development of space transportation technologies and systems that support our customers' needs—strengthening the U.S. launch industry, dramatically increasing safety and reliability, and reducing overall cost.
- Lead NASA's Microgravity Research and Space Product Development Programs, and develop and maintain capabilities required to meet national research objectives.
- Lead the Agency in the development of lightweight, large- aperture space optics manufacturing technology for use in achieving the mission goals of NASA's strategic enterprises.
- Enhance and sustain a highly skilled, ethical, diverse, and motivated workforce committed to safety while working in a creative and productive environment in support of cutting-edge systems and technology development.

CENTER OF EXCELLENCE

- Space Propulsion

MISSION AREAS

- Space Transportation Systems Development
- Microgravity
- Space Optics Manufacturing Technology

DIRECTOR'S MESSAGE

I am pleased to present the Marshall Space Flight Center FY 2001 Implementation Plan. This plan outlines our roles and responsibilities as a NASA Field Center. It also defines the journey we will take to carry out Agency and Enterprise goals and objectives. The plan distinguishes the direction of the Center, and focuses on our mission as the Center of Excellence for Space Propulsion; and, it outlines our leadership in Space Transportation Development, Microgravity, and Space Optics Manufacturing Technology. It also addresses the many other ways we support NASA's missions.

Our first commitment is to safety. Safety must be at the forefront of our thoughts and actions, whether at work or at home. NASA is committed to upholding its dedication to safety of the public, our astronauts and pilots, our employees, and the Agency's high-value assets.

Our core values represent the compass by which we set our course. The value we place on people, customers, excellence, teamwork, and innovation needs to be evident in everything we do.

To be successful, we recognize that people are our greatest asset and that providing them a safe environment, encouraging balance, respecting diversity, and upholding integrity are imperative. We must continually strive to deliver quality products and services to our customers, and be accountable to deliver on our promises. Our commitment to teamwork and innovation, in all areas, will continue to be our standard.

Congress has given us a vote of confidence by fully funding the Space Launch Initiative program. We will honor that vote through our hard work and our commitment to effective teamwork across the Agency and with industry.

In meeting NASA's Strategic Plan, Marshall will continue its role as a major contributor to all five of NASA's Enterprises: Human Exploration and Development of Space, Aerospace Technology, Space Science, Earth Science, and Biological and Physical Research.

The FY2001 Implementation Plan gives us only a glimpse of the excitement ahead for Marshall Space Flight Center. I encourage each of you to read this plan and find your place on this roadmap to success.

I fully expect the Marshall team, including our contractors, to continue to perform to the high standard of excellence for which we are known, and have fun doing it.

Art Stephenson
Center Director

TABLE OF CONTENTS

COMMITMENT TO SAFETY AND MISSION SUCCESS

Our goal: Establish MSFC as number one in safety within NASA.

MSFC'S SAFETY POLICY

MSFC will strive to prevent human injury and occupational illnesses and ensure safety of all operations and products.

MSFC SAFETY PRINCIPLES

- Unsafe conditions are correctable.
- All mishaps can be prevented.
- Management is responsible and accountable for prevention of on-the-job mishaps (incidents, close calls, etc.).
- All mishaps must be reported, investigated, and the causes rectified.
- Management is responsible for training employees to work safely.
- Each employee is responsible for safety.
- Off-duty safety is an important part of MSFC's safety success.
- A comprehensive safety and risk management program increases the probability of mission success.

SAFETY MANAGEMENT PROGRAMS & TECHNIQUES

MSFC has implemented unique and innovative management techniques to improve safety of the public, the astronauts and pilots, the NASA workforce, and high-value equipment and property.

CURRENT SAFETY PROCESSES AND ACTIVITIES

- An occupational safety, health, and environmental committee structure steers the MSFC safety program. It includes participation from top management down through line supervisors, an employee safety action team, and a contractor safety forum.
- Safety and Mission Assurance (S&MA) is organized to effectively support the MSFC organizational structure while maintaining collocation in major project offices and contractor plants.
- Senior management safety review process.
- Both S&MA and Center Operations internet web pages contain pertinent employee safety information and are frequently enhanced.
- The Safety Concerns Reporting System has been improved and is used frequently by employees to report concerns.
- Risk Management planning, consulting and training are available to support project risk management and development.
- Continue effort toward OSHA Voluntary Protection Program Star Certification.
- All MSFC managers,supervisors, and employees have been trained in MSFC's new occupational safety and health philosophy and process.
- All MSFC Safety and Quality Management System documentation is contained in a single Integrated Document Library.
- All major management meetings include a safety discussion.
- Managers and supervisors conduct monthly safety meetings, perform monthly workplace occupational safety and health audits with employees, and ensure employees have appropriate safety training.

- Occupational safety and health information is widely disseminated using multiple media.
- All mishaps are investigated to determine root causes. Findings are used for trending and recurrence prevention.
- Safety performance is included in job descriptions and performance evaluation plans of all employees.

FY 2001 SAFETY INITIATIVES

Use the Agency Safety and Health Initiative Model to continue improvement in the MSFC Safety Program. Implement a program that will meet or exceed OSHA Star certification standards and submit for certification when ready.

Management Commitment and Employee Involvement

- Implement a web-based program to assist supervisors in conductiong monthly safety meetings and walk-throughs, and to track any subsequent actions
- Make worksite safety documentation user friendly
- Implement employee involvement activities
- Ensure public safety during X–34, X–37, and X–40 flight testing

System and Worksite Hazard Analysis

- Perform job hazard analyses for all jobs at MSFC
- Improve communication of lessons learned from mishaps and close calls

Hazard Prevention and Control

- Train supervisors to perform job hazard analyses
- Develop contractor safety performance evaluation methods

Safety and Health Training

- Provide all onsite contractor employees with safety and health philosophy and process training
- Reinforce safety philosophy to managers, supervisors, and employees

SAFETY AND MISSION SUCCESS METRICS

- Achieve a world class lost-time mishap rate of 0.1 or less with the ultimate goal of 0
- All MSFC projects successfully complete their safety reviews on time

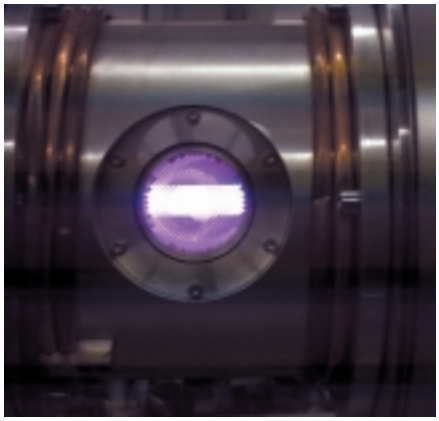
Center of Excellence:

SPACE PROPULSION

Our goal: Develop and maintain NASA's pre-eminence in space propulsion, enabling the exploration and development of space while dramatically increasing program and mission safety and reliability and reducing overall cost.

WE SUPPORT

- Human Exploration and Development of Space Enterprise
- Aerospace Technology Enterprise
- Space Science Enterprise
- Industry and Commercial Needs
- Other Federal Agencies



Gas Dynamic Mirror Fusion Propulsion Experiment.

Test of the low-cost MC–1 rocket engine.

As NASA's designated Center of Excellence for Space Propulsion, the Marshall Center leads the Agency's efforts in development, implementation and advocacy of advanced Earth-to-orbit and in-space propulsion systems and technologies.

It is Marshall's responsibility to maintain and continuously improve the skilled personnel, processes, facilities and support factors that constitute this Center of Excellence. These efforts are critical to enable the development of new and innovative space propulsion technologies, as well as timely reporting of these technologies and their transfer into commercial applications—enhancing U.S. industrial growth and improving the quality of life on Earth.

Marshall provides space propulsion services to all NASA enterprises, and supplies critical leadership for joint efforts among NASA field centers, industry, academia and other Government agencies.

Space propulsion encompasses the energy storage, transfer and conversion subsystems and components required to propel a space transportation system or maneuver a spacecraft. NASA engineers are working to develop Earth-to-orbit, in-space transfer, and on-board spacecraft propulsion systems that deliver higher performance and aircraft-like reliability with significant reduction in overall cost.

Earth-to-orbit propulsion includes rocket, augmented rocket, and combined-cycle propulsion, which may include air or magnetic launch assist. In-Space transfer propulsion includes orbit transfer and atmospheric re-entry, deep space propulsion and systems enabling surface excursion. Spacecraft propulsion includes spacecraft and satellite maneuvering, as well as positioning systems for orbiting craft such as the International Space Station.

A variety of system, subsystem and component technologies are being developed and demonstrated for each propulsion type, both in ground and flight tests.

EARTH-TO-ORBIT PROPULSION

Near-term activities devoted to increasing the performance margin of Earth-to-orbit propulsion systems—while lowering operations, development and manufacturing costs—are focused on enabling a long-life, high thrust-to-weight rocket-based reusable launch vehicle by the end of the decade. Technologies now in development to meet this goal include lightweight composite thrusters; advanced altitude-compensating nozzle concepts such as aerospike; composite lines, ducts and housings; ceramic turbines; and other low-cost components.

Leveraging near-term developments and building on the synergy between space and aeronautics programs, mid-term technology activities now being demonstrated at Marshall are intended to enable a new generation of air-breathing, combined-cycle rocket engines. Mid-term efforts also include evaluation of new engine concepts, such as pulse detonation and the use of

high-energy density fuels. Efforts will continue to further increase life and thrust-to-weight of rocket engines.

Long-term technologies include revolutionary off-board energy sources, such as magnetic launch assist, ground-based laser, and microwave propelled systems.

IN-SPACE PROPULSION

More than 70 percent of all payloads need transportation beyond low-Earth orbit. The key to enabling successful next-generation systems is increasing propulsion system efficiency while decreasing its mass. Solar-electric propulsion systems, electrodynamic tethers, solar sails, and advanced chemical engines are some of the in-space propulsion technologies Marshall and its partners are now pursuing to enable Earth-orbital and planetary transportation.

Ambitious missions to destinations within the solar system and beyond will require significant advances in propulsive capability. This is especially true for enabling human exploration, which requires dramatic reductions in trip time as well as assurance of safe and reliable mission operations. Technologies now being researched include propulsion concepts based on fission, antimatter, and fusion energy sources.

INTERNATIONAL SPACE STATION PROPULSION

Among Marshall's in-space propulsion development activities is support for the International Space Station, now being assembled in orbit. The Space Station requires four types of propulsion: altitude control to maintain proper orbit; attitude control to reposition or realign the station; anti-collision control to avoid debris or other orbiting bodies; and periodic propulsive desaturation of the control moment gyroscopes, which reposition the Station without thruster firings. The current *ISS* plan utilizes three propulsion methods: the Russian Service Module, the Interim Control Module and the United States Propulsion System (USPS). The Marshall Center manages development of the latter two methods.

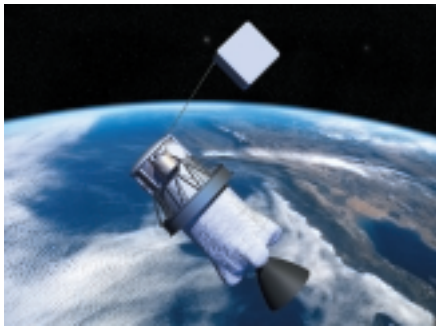
Development is also underway on a long-term, emergency Crew Return Vehicle for the Space Station, to be based on NASA's X–38 technology demonstrator now undergoing flight tests at Johnson Space Center in Houston. The Marshall Center is leading development of the De-Orbit Propulsion Stage, the vehicle's propulsion system, which powers the craft's re-entry into the atmosphere and then is conveniently jettisoned after the de-orbit burn is completed.

THE PROPULSION RESEARCH CENTER

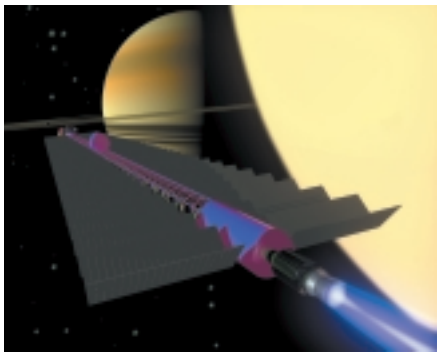
Missions to near-interstellar space—and eventually to other stars—will require performance well beyond even those capabilities envisioned for interplanetary space flight. The Marshall Center's Propulsion Research Center serves as a national resource for studies and investigations of advanced and alternate propulsion technologies, such as beamed energy sails, advanced fusion systems, matter/antimatter annihilation and speculative motive physics. Scientists and engineers from NASA, industry, academia and the U.S. Departments of Energy and Defense will pool their skills and expertise to perform landmark research on-site at Marshall.

SPACE PROPULSION METRICS

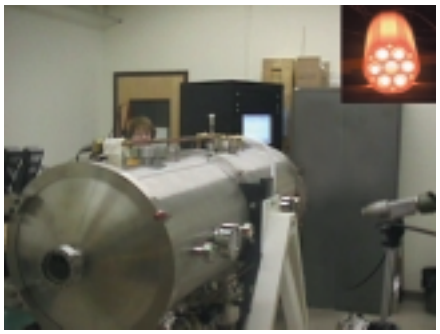
- Fly ProSEDS Tether propulsion flight experiment
- Complete Propulsion Research Laboratory (PRL) engineering study; initiate PRL design effort
- Complete X-38 De-Orbit Propulsion System hardware integration



Propulsive Small Expendable Deployer System (ProSEDS).



The use of fusion for propulsion has the potential to open the entire solar system for exploration.



Heatpipe Bimodal Reactor Module Test.

Mission:

SPACE TRANSPORTATION SYSTEMS DEVELOPMENT

Our goal: Lead the research and development of space transportation technologies and systems that support our customers' needs—strengthening the U.S. launch industry, dramatically increasing safety and reliability, and reducing overall cost.

WE SUPPORT

- Human Exploration and Development of Space Enterprise
- Aerospace Technology Enterprise
- Space Science Enterprise
- Earth Science Enterprise
- Industry and Commercial Needs
- Other Federal Agencies

MSFC has responsibility for research, technology maturation, design, development, and integration of space transportation and propulsion systems. This includes both reusable space transportation systems for Earth-to-orbit applications, as well as vehicles for orbital transfer and deep space transportation.

SPACE SHUTTLE ELEMENTS

MSFC's Space Shuttle projects manage safe, continuous, robust, and cost-effective operations for the Space Shuttle propulsion elements: External Tank, Solid Rocket Booster, Reusable Solid Rocket Motor, and Space Shuttle Main Engine. MSFC will continue to streamline operations and aggressively develop and implement significant upgrades to enhance safety, meet the manifest, improve mission supportability, and improve the system to sustain the Space Shuttle for its lifetime.

SPACE SHUTTLE METRICS

- Maintain less than one in-flight anomaly (IFA) per mission
- WORK FORCE SAFETY: Conduct the following Safety Initiatives to insure a safe workplace environment:
  - Monthly Area Walkthroughs and Documentation
  - Monthly Project Safety Meetings
- Maintain safety performance records at our contractor facilites which exceed industry standards.
- Enhance safety, assure Mission Supportability and sustain the life of the Shuttle. To improve the reliability of the Space Shuttle, Propulsion System upgrades, such as the following, are to be incorporated:
  - External Tank Friction Stir Welding
  - Space Shuttle Main Engine Advanced Health Management
  - Reusable Solid Rocket Motor Propellant Grain Geometry Modification
  - Solid Rocket Booster Advanced Thrust Vector Control (ATVC)
- Meet the Manifest and Improve Mission Supportability through:
  - Robust Processes
  - Process Control
  - Production Process Efficiency
  - On-Time launches with no delays attributable to the MSFC Propulsion Elements

Shuttle Atlantis.

External Tank and Solid Rocket Boosters.

Space Shuttle Main Engine.

ADVANCED SPACE TRANSPORTATION TECHNOLOGY

As NASA's lead center for Space Transportation Systems Development, Marshall Space Flight Center is spearheading the development of safer, more cost-efficient technologies for 21st-century space transportation. Partnering with NASA field centers, industry, academia and other Government agencies, Marshall seeks to restore U.S. dominance over the worldwide launch industry, paving the highway to space for generations to come.

In 1999, NASA's Integrated Space Transportation Plan defined the Agency's long-term investment strategy for all its diverse space transportation efforts. By investing in a sustained progression of targeted research and technology initiatives, NASA is realizing its vision for generations of reusable launch vehicles that will surmount the Earth-to-orbit problem—allowing us to set our sights on our neighboring planets and the stars beyond.

The Marshall Center manages all aspects of technology identification and maturation, research, design, development and integration of space transportation and propulsion systems. This responsibility includes existing and next-generation reusable space transportation systems, as well as vehicles for orbital transfer and deep space transportation.

Rocket-Based Combined Cycle and magnetic sled advanced technology demonstrator concept.

Perhaps most importantly, Marshall is leading the way toward exponential improvements in flight safety and reliability and dramatic reductions in the cost of getting payloads to space—from $10,000 per pound today to $1,000 per pound by 2010, and to mere hundreds of dollars per pound by 2025. Such measures will improve the safety, comfort and affordability of space transportation so dramatically that ordinary people may have the opportunity to visit space.

THE SPACE LAUNCH INITIATIVE

The key to opening the space frontier, the new U.S. Space Launch Initiative is a comprehensive, long-range plan to increase commercial development and civil exploration of space, providing strategy and funding for second-generation reusable launch vehicles, as well as investments in NASA-unique systems and near-term alternate access to the International Space Station. Spearheaded by the Marshall Center, the Space Launch Initiative promises a new era of commerce, competition and human discovery in space.

SECOND-GENERATION RLVs

The overall goal of the 2nd-Generation RLV Program is to substantially reduce technical and business risks associated with developing safe, affordable and reliable reusable launch vehicles (RLVs). Program investments will emphasize risk reduction to be selected according to industry and NASA needs, including technology development and demonstration, business and program planning, design and advanced development. NASA will build on the foundation of ongoing efforts—such as the X–33, X–34, X–37 and Advanced Space Transportation Programs—to further reduce technical and programmatic risks, thereby enabling full-scale development of at least two competitive, commercial RLV architectures by 2005, with full operations readiness anticipated by 2010.

ALTERNATE ACCESS

The Space Launch Initiative includes focused investment for enabling near-term, commercial launch alternatives to ferry spares, logistics materials and other cargo to the International Space Station. The Alternate Access program offers established and emerging launch companies the opportunity to develop unique technologies, system designs and innovative procurement mechanisms, all of which are intended to fully integrate with 2nd-Generation RLV activities. NASA currently is completing studies with private industry to develop strategies for obtaining alternate access systems.

ASTP: THIRD-GENERATION RLVs... AND BEYOND

NASA's Advanced Space Transportation Program at Marshall is already looking beyond 2nd-Generation RLVs, investing in propulsion and vehicle technologies that will reduce the cost of space transportation to hundreds of dollars per pound by 2025 and increase safety and reliability to that of modern air transportation—forever changing the way human beings travel.

Third-generation RLVs could get a running start on a magnetic levitation track now in development by NASA, or receive propelling force from a rocket engine that "breathes" oxygen from the air during the climb

to orbit. Propulsion systems that boost spacecraft with laser beams and propellant-free electrodynamic tethers also could become operational within the first half of this century. Within 15 years, such technologies are expected to demonstrate performance improvements that will reduce trip time and mass by a factor of 2 to 3 and cost by a factor of 10.

X-VEHICLES

NASA is demonstrating advanced space transportation technologies via a series of flight experiments and experimental vehicles designed to support the Agency's goal of dramatically reducing the cost of access to space. Managed by the Marshall Center, the X–33, X–34 and X–37 programs are paving the way to a new era of space development and exploration.

X-33 PROGRAM

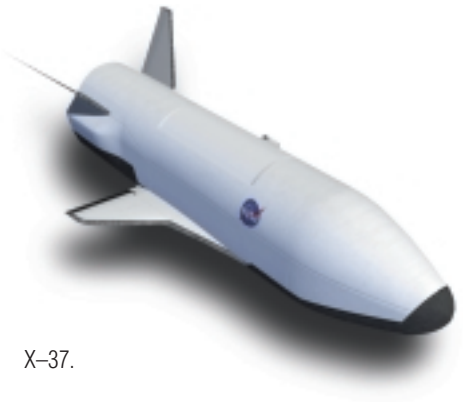
The X–33 technology demonstrator is intended to establish key design and operational aspects of a single-stage-to-orbit (SSTO) reusable launch system. Primary objectives include: reduction of business and technical risks, enabling privately financed development and operation of a next-generation reusable space transportation system; testing of the X–33's flight system, subsystems and major components to ensure traceability and scalability to a full-scale SSTO system; improved mass fraction for vehicle structures and improved thrust-to-weight for rocket propulsion systems; and demonstration of key, aircraft-like operational attributes.

X-34 PROGRAM

The primary objective of the X–34 is in-flight demonstration of key operational and vehicle technologies leading to significant reductions in space launch costs. These key technologies include those embedded in the vehicle's design, as well as technologies hosted aboard the X–34 as test articles or experiments.

X-37 PROGRAM

The X–37 will be the first of NASA's experimental demonstrators to operate in both the orbital and reentry phases of flight. The autonomous space plane will demonstrate up to 40 advanced airframe, propulsion and operations technologies that can support various launch vehicle and spacecraft designs.



X–37.

PATHFINDER FLIGHT EXPERIMENTS

Pathfinder flight experiments demonstrate a variety of advanced launch vehicle and spacecraft technologies, including nontraditional propulsion systems, improvements and innovations to conventional propulsion systems, safe abort capability, vehicle health management systems, composite structures and new thermal protection systems. These experiments—such as the ProSEDS electrodynamic tether propulsion demonstrator and the T-160E Hall Effect Thruster System—fly on a number of platforms, including Pathfinder demonstration vehicles, satellites, the Space Shuttle, reentry vehicles and other appropriate systems.

NEXT-GENERATION LAUNCH SERVICES

Because next-generation launch vehicles and spacecraft require next-generation launch facilities and spaceports, NASA has appointed Marshall as lead center for acquisition and management of Next-Generation Launch Services (NGLS) for all Category 1 missions.

Providing NASA with a contractual mechanism to acquire launch services on emerging, commercial expendable and reusable launch systems, NGLS offers start-up launch companies an opportunity to support NASA payload manifests, as well as a mechanism for providing demonstration flights to the International Space Station.

ADVANCED SPACE TRANSPORTATION TECHNOLOGY METRICS

- Complete X–40A approach and landing test series
- Complete X–37 design
- Complete X–34 captive-carry testing
- Conduct initial, unpowered flight of X–34
- Complete initial X–34 unlined composite LOX tank test series
- Conduct integrated X–34 propulsion testing with MC-1 engine
- Conduct post-flight analysis of SHARP-B2 flight experiment
- Complete validation of polymer matrix composite cryogenic LH2 and LOX tanks including:
  - Compatible materials systems and processes
  - Fabrication and joining technology for large-scale articles
  - Demonstrated thermal performance
- Complete Systems Requirements Review (SRR) for RBCC Demonstrator Engine
- Complete competitive solicitations and award multiple industry contracts for 2nd-Generation RLV Requirements Definition and Risk Reduction Effort
- Release RFP, perform evaluations and negotiate contract for NGLS
- Complete and review results of Alternate Access Study contracts; release follow-on RFP
- Complete Dual Engine testing for X–33 flight engines
- Complete design of X–33 metallic LH2 tanks

Mission:

MICROGRAVITY RESEARCH IN SPACE

Our goal: Lead NASA's Microgravity Research and Space Product Development Programs, and develop and maintain capabilities required to meet National research objectives.

WE SUPPORT

- Human Exploration and Development of Space Enterprise
- NASA-Approved Principal Investigators
- National Scientific Community
  - Academia
  - Industry
  - Government
- Commercial Space Centers and Industry Partners
- American Companies/ Industries

Dendrites, which are materials microstructures, are frequent objects of study in microgravity.

Commercial microgravity research is available to help industry study and improve on procedures, protocols, and drugs.

MSFC's Microgravity Research Program Office (MRPO) is responsible for implementing the Agency's microgravity initiatives. MSFC's efforts enable scientific and commercial researchers the unique opportunity to use the low-gravity environment of space as a catalyst to generate new knowledge, products, and services that improve the quality of life on Earth.

MRPO accomplishes this mission by providing program management of research and associated instrumentation, apparatus and facilities sponsored by the Human Exploration and Development of Space Enterprise (HEDS). Resources are provided by the Office of Fundamental Space Research through both its Microgravity Research and its Commercial Research and Space Product Development Divisions, and the Office of Space Flight through its International Space Station Payloads Office.

The MRPO implements MSFC's Microgravity Lead Center assignments by administering and managing grants, cooperative agreements and contracts; managing the development of specialized instrumentation, flight hardware and multi-user research facilities; and manifesting flight opportunities on parabolic aircraft, suborbital rockets, free-flyers, the Space Shuttle, and the *International Space Station* (ISS). MRPO provides research support through gloveboxes, accelerometers and vibration isolation opportunities; conducts advanced and focused technology development programs; and provides education and outreach to the research community, industry, and the public. MRPO delegates technical management of individual science disciplines to supporting field centers. Supporting Centers include the Jet Propulsion Laboratory (Fundamental Physics), the Glenn Research Center (Combustion Science and Fluid Physics and Transport Phenomena), and the Marshall Space Flight Center (Biotechnology and Materials Science). The Johnson Space Center supports the Biotechnology subdiscipline of Cellular Science. Program Management oversight and control are accomplished by MRPO with direct involvement of the supporting field centers through the Microgravity Research Team. The MRPO also collaborates with other programs within the Agency and the HEDS Enterprise, and implements international agreements and collaborations with international partners. Current Agency collaborations include participation in the Decadal Planning Team, membership on the In-Situ Resource Utilization Steering Committee, participation in the development of radiation shielding strategies and diagnostics, Cross-Enterprise Technology Development collaborations, and membership on the *ISS* Preplanned Program Improvement initiative. In addition, as a member in the joint efforts of the Advanced Project Division of the Office of Space Flight and the Office of Fundamental Space Research, Agency activities to promote the commercial development of space have been initiated.

Payload specialist Dr. Roger Crouch conducting research in a microgravity glovebox.

MICROGRAVITY RESEARCH PROGRAM

The mission of the Microgravity Research Program is to use the environment of space to obtain new knowledge and increase the understanding of natural phenomena in biological, chemical and physical systems, especially with regard to the effects of gravity which may be obscured on Earth. The Microgravity Research Program also facilitates the application of such knowledge to commercially viable products, processes and services.

Microgravity researchers are provided the unique opportunity to study natural processes and phenomena in the near absence of gravity. Comparison between ground- and space-based research data allows scientists to accurately understand the role gravity plays in everyday life. Low-gravity research also allows scientists the opportunity to explore phenomena normally obscured by the effects of gravity. Scientists selected into the program perform peer-reviewed investigations in the research areas of biotechnology, combustion science, fluid physics, fundamental physics, and materials science. MSFC manages the implementation of the program, including the development of major facilities to be permanently housed on the *International Space Station* and available to the science community for unique low-gravity research opportunities.

MICROGRAVITY RESEARCH METRICS

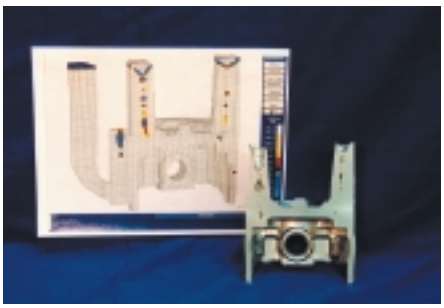
- Support at least 450 investigations.
- Support at least 10 Science Concept Reviews (SCR) and 15 Requirements Definition Reviews (RDR).
- Conduct research on at least 12 KC–135 flight campaigns to produce selected science and engineering data.
- Conduct 2 sub-orbital sounding rocket flights.
- Conduct goal directed workshop to define methods, databases, and validating tests for material flammability characterization, hazard reduction, and fire detection/suppression strategies for spacecraft and extraterrestrial habitats.
- Conduct Biotechnology, Fluid Physics and small multi-discipline investigations on the ISS according to the U.S. Partner Utilization Plan.
- Use the rotating bioreactor to model microgravity for microbes and mammalian cells to identify potential parameters.

SPACE PRODUCT DEVELOPMENT

The mission of the Space Product Development (SPD) Program is to encourage and facilitate the use of space for the development of commercial products and services. In fulfilling this responsibility to encourage the fullest commercial use of space, the SPD program is managing an organization of Commercial Space Centers (CSC's) that have successfully employed methods for encouraging private industry to exploit the benefits of microgravity research. The unique opportunities of this environment are being made available to private industry in an effort to develop new competitive products, create jobs, and enhance the quality of life. The success of the CSC's research is evidenced by the increasing amount of industrial participation in commercial microgravity research and the potential products nearing marketability.

SPACE PRODUCT DEVELOPMENT METRICS

- Provide leadership and support to ensure that all SPD payloads meet ground and flight safety requirements.
- Provide policies and resources to enable at least 50 undergraduate and graduate students to participate in commercial space flight and technologies research.
- Provide policies and resources to enable at least 10 new active industrial partnerships to be established with the Space Product Development Commercial Space Centers.
- Initiate review of all SPD CSCs using criteria based on established policies and operating principles.
- Review Annual Report, recommend and implement additions or changes for FY 2001 report.
- Support at least four industrial conferences with Space Product Development displays and information booths.



The Forced Flow Flame-Spreading Test was designed to study flame spreading over solid fuels when air is flowing at a low speed in the same direction as the flame spread.

MICROGRAVITY SCIENCE AND APPLICATIONS

MSFC is responsible for implementing the Materials Science and Biotechnology Science disciplines and the Glovebox Program within the Microgravity Research Program. To implement the Program, MSFC has a unique team of scientists, engineers and managers teamed with industry, academia, and international individuals and organizations to establish and maintain world-class research in those fields. MSFC also is responsible for providing glovebox facilities on the Shuttle and ISS for the purpose of supporting low-cost and fast-track investigations from all disciplines of the Microgravity Program.

MSFC is responsible for the financial and managerial administration of all selected investigations, assistance in the definition of focused science objectives, access to ground and flight facilities and carriers, definition and development of new enabling research technology, definition and development of scientific apparatus and facilities, mission operations support, and transfer of the accumulated microgravity database.

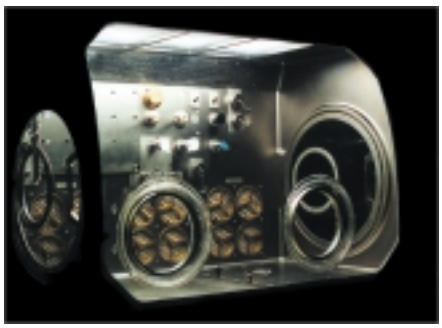
Rack Mounted Glovebox for Spacehab and Shuttle Mid-Deck.

GLOVEBOX

Glovebox Program is for investigators who wish to fly small, laboratory type experiments in manned flight facilities such as the Shuttle and the International Space Station. The program maintains a rack-mounted unit that flies regularly in the Spacehab module in the Shuttle cargo bay, and is developing a larger, full rack system for the ISS. These units are designed to allow an investigator to develop an experiment on his laboratory bench top and then fly essentially the same design in space where the flight crew operates it in microgravity. The investigator can participate closely in the flight operation through video and real-time data links. In addition to providing the flight facilities, the Program also helps the investigator build experiment hardware and handles most of the required documentation and safety measures required of all NASA space flight activities.

GLOVEBOX METRICS

- Deliver the Microgravity Science Glovebox Facility to ISS for the UF1 flight.
- Deliver the vibration isolation system Glovebox Integrated Microgravity Isolation Technology (g-LIMIT) to *ISS* for the UF1 flight.
- Integrate 3 experiments into MSG for UF-1 Flight



Work Volume of the ISS Microgravity Glovebox.

MATERIALS SCIENCE RESEARCH

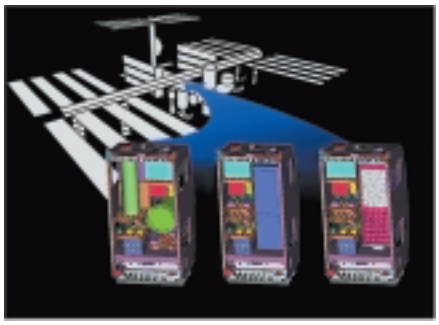
The Materials Science Program deals with the relationships among the processing, structure, and properties of materials. The goal is to control the processing to yield materials with exceptional properties and enhanced performance. Materials scientists seek to understand the formation, structure, and properties of materials on various scales ranging from atomic through microscopic and to very large macroscopic levels. The relationship between the structure of a material and its physical properties is a key element in the study of materials, as is the manipulation of various processing parameters to obtain a desired structure.

Basic materials science research programs study the fundamental and direct relationship between gravity and certain biological, chemical, and physical processes, in which case, gravity is used as an experiment variable. The International Space Station (ISS) will give the scientists an opportunity to conduct long-duration microgravity science investigations.

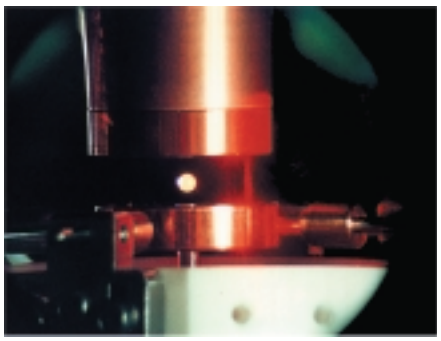
The Materials Science Research Facility (MSRF), a key development effort at MSFC, will be the primary facility for microgravity materials science research on board the International Space Station (ISS). It will operate in the U.S. Laboratory Module and accommodate the current and evolving cadre of Microgravity Materials Science Investigations by providing the apparatus for satisfying near-term and long-range research objectives.

MATERIALS SCIENCE RESEARCH METRICS

- Deliver 4 Science Concept Reviews
- Deliver 6 Requirements Definition Reviews
- Releasing Materials Science 2000 NASA Research Announcements



The 3 Rack Complement of the Materials Science Research Facility (MSRF).



Molten Sample Suspended Between the Electrostatic Levitator Electrodes.

MOLECULAR BIOTECHNOLOGY

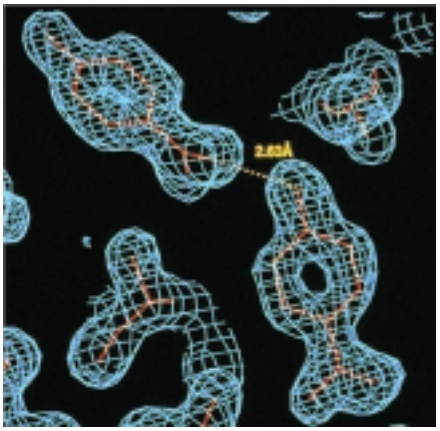
MSFC is the focal center for the study of molecular biophysics and biochemistry for the microgravity program. Historically, the program has been focused on use of the low gravity environment to assist researchers in performing experimentation to answer both fundamental and applied scientific questions. New directions include branching out beyond the constraints of research dominated by low gravity experimentation. The current focus of the Molecular Biotechnology Program is on structural biology. In essence, this is the study of the fundamental building blocks of life. That information is critical to advancing knowledge in a wide variety of areas. Specifically the goals of the program are to:

- Provide capability to the agency to answer the basic question of the existence of life, simple or complex, beyond the planet Earth.
- Provide capability to the agency to the study of biological systems that may assist the exploration and development of space. That study includes both the understanding of the fundamental role of gravity and radiation in vital biological systems and the application of biology based systems to perform tasks current performed by inorganic systems.
- Transfer or enable the transfer of knowledge gained from the research into products and to improve the quality of living in Earth and in space.

MOLECULAR BIOTECHNOLOGY METRICS

- Fully implement the recommendations of the National Research Council.
- Develop and implement a method to radically accelerate the time between idea and data recovery for scientists desiring to perform Structural Biology experiments in low gravity.
- Identify, form partnerships, and perform exploratory experimentation in biomaterials and nanotechnology to support NASA goals in Bioastronautics and Astrobiology.

Dr. Dan Carter and Charles Sisk prepare a crystal for x-ray.



Electron probability map of molecule.

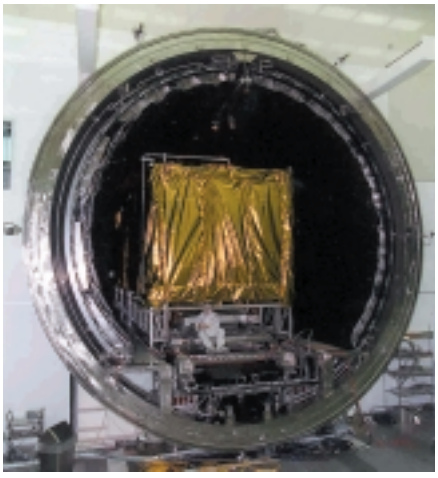
Mission:

SPACE OPTICS MANUFACTURING TECHNOLOGY

Our goal: Lead the agency in the development of lightweight, large-aperture Space Optics Manufacturing Technology for use in achieving the mission goals of NASA's strategic enterprises.

WE SUPPORT

- HEDS Enterprise
- Space Science Enterprise
- Earth Science Enterprise
- Aerospace Technology Enterprise
- Industry and Commercial Needs
- Other Federal Agencies



X-ray Calibration Facility Test Chamber.

Optics is an essential part of NASA's missions. The continuing exploration of the universe requires ever increasing apertures. The development of lightweight optics and optical systems is key to the reduction of launch costs.

The Space Optics Manufacturing Technology Center (SOMTC) is continuing the development of new technologies for the production of large-aperture, lightweight optics for space-based systems. SOMTC is managing and evaluating the development of advanced mirror technologies for use in space based observatories including the Next Generation Space Telescope and the Constellation X-ray mission.

SOMTC is organized into four functional groups: Advanced Concepts Group, Optical Test Group, Optical Design, Analysis and Coating Group, and the Optical Fabrication Group.

Advanced Concepts being developed include ultra-lightweight optics, adaptive optics, and alignment techniques for segmented optical systems. Ultra-lightweight optics includes membrane optics, inflatable optics, and replicated optics. The goal is to eventually get to 0.1 kg/m^2. Normal incidence replicated mirrors have already been produced at 1.0 kg/m^2. Further development of the control of the replication process is on going to improve the optical quality.

Proof-of-concept demonstrations are in process for solar pumped and solid-state dye lasers for power beaming applications. Demonstration is being developed for segmented concentrators for photovoltaic systems with a performance goal of 1 kw/kg in support of Space Solar Power and megawatt Solar Electric Propulsion Systems.

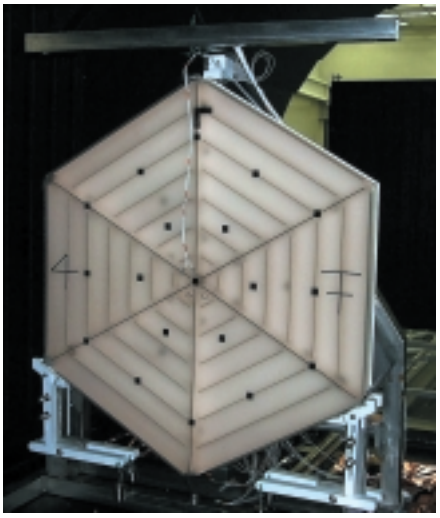
Optical Test provides state-of-the-art x-ray testing and optical testing under cryo-vac conditions. The group utilizes the X-ray calibration facility, XRCF, and the stray light test chamber. These facilities support testing at wavelengths from x-ray through the infrared. The XRCF has been outfitted with a helium shroud that allows testing below 35°K. The XRCF will be in continuous operation through the plan period evaluating advanced mirror manufacturing technologies for the Next Generation Space Telescope, NGST. The group is working with two contractors to help evaluate the performance additional mirror and metering structure concepts for NGST. The XRCF will also continue to provide the x-ray testing for the Solar X-ray Imager Telescopes.

Optical Design, Analysis and Coating provides the optical design, opto-mechanical design, optical metrology and optical coatings for all systems in SOMTC. The optical metrology team has the capability for measuring the surface finish and figure in process, after completion of the optic and final acceptance of the assembled system. Optical analysis includes performance predictions of optical and X-ray systems based on the component tests. The prediction capability ensures compliance of the final system with the performance specifications. The optical coating team has the resources to produce both metallic and dielectric coatings on substrates up to 4 meters in diameter.

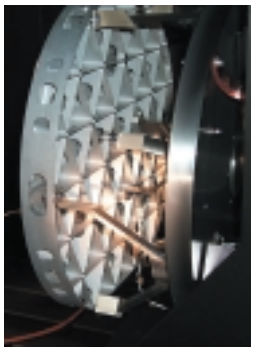
Optical Fabrication included classical optical processing, single point diamond turning, computer controlled polishing and ion milling. The classical optical processing operation has capability to 0.5-meter aperture. The single point diamond turning has capability of turning components up to 1.5 meters in diameter. An additional machine with 1-meter capacity was recently acquired and is awaiting installation. A machine shop supplies small parts and tooling for the optical fabrication group.

SPACE OPTICS MANUFACTURING TECHNOLOGY METRICS

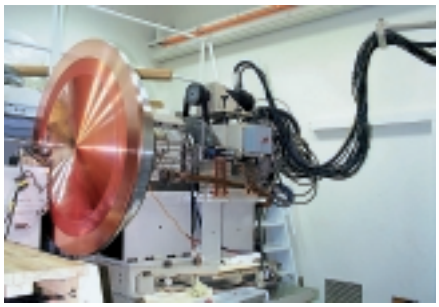
- Produce a solar collector quality mirror with areal density of <0.1 kg/m^2
- Complete the installation of the inductive edge sensors on a segmented ground-based telescope.
- Produce 0.5-meter diameter replicated optic of optical quality and <1.0 kg/m^2 .
- For NGST, test two additional mirror technologies as the suppliers deliver them.
- For Constellation X-ray, continue improvement of the resolution by a factor of 2.
- Implement continued process improvements in the XRCF to reduce the cost of testing by an additional 5%.
- Install the additional single point diamond turning machine. Establish a financially self-sufficient group within two years.
- Demonstrate 4-fold efficiency increase for solar pumped laser.
- Define a 2-10 megawatt Solar Electric Propulsion system for outer planet exploration using derived Space Solar Power technology.
- Develop and demonstrate neuro-fuzzy logic controller for active segmented optics.



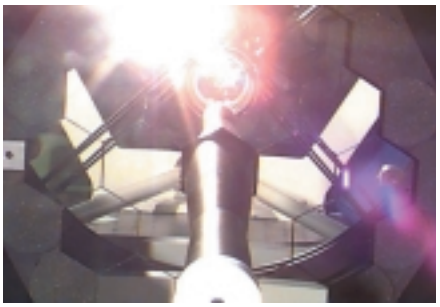
1.6m glass face sheet with composites back structure.



0.5 Beryllium mirror in cryo test.



Fresnel lens mandrel on M40 Diamond Turning Machine.



Phased Array Mirror Extendible Large Aperture (PAMELA).

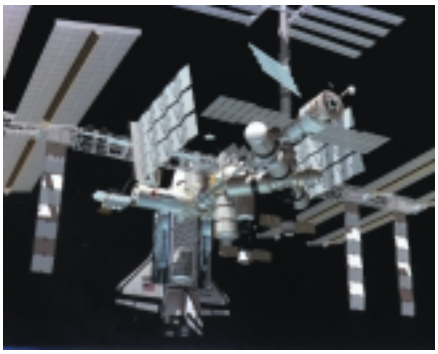
FLIGHT PROJECTS

The following is a brief summary of flight project assignments being implemented by MSFC for the NASA Enterprises and other Lead Centers.

INTERNATIONAL SPACE STATION

WE SUPPORT

- Human Exploration and Development of Space Enterprise



International Space Station.

MPLM Flight Module 2 in the Element Rotation Stand at Kennedy Space Center.

Payload Operations Integration Center.

The International Space Station (*ISS*) is a U.S.-led, international partnership program to build and operate a unique, world-class orbiting laboratory, free from the effects of gravity. Long-term scientific and technology development will be conducted for the benefit of life on Earth and the continued exploration and development of space.

Marshall supports the *ISS* program through task agreements with the *ISS* Program Office at the Johnson Space Center (JSC). Marshall plays a vital role in building, operating, and utilizing the *ISS* for NASA through the performance of these tasks.

Specifically, Marshall is providing management oversight of Nodes 2 and 3, which will be provided by the Italian Space Agency (ASI) and their contractor, Alenia. The purpose of these sections of the United States On-Orbit Segment (USOS) is to act as a building block to connect utilities, and provide a pressurized passageway between berthed elements. Commands and data will be distributed/transferred, as well as audio, video, electrical power, thermal energy, atmosphere, and water. Also, the crewmember's toilet and cleansing areas will be provided.

Marshall also provides management oversight of the Interim Control Module being built by the Naval Research Laboratory, and the United States Propulsion System. The USPS incorporates a propulsion module and a Node 4 docking module element.

Marshall is responsible for the development of the regenerative life support systems for the *ISS* crew and the research animals. The *ISS* crew will be provided a comfortable environment in which to live and work. Collectively, this is called the Environmental Control and Life Support System (ECLSS). The Marshall managed portions of the ECLSS will include the development of the Water Recovery System (WRS) to recycle wastewater (including urine) to produce drinking (potable) water, storage and distribution of potable water, and use of the WRS recycled water to produce oxygen for the crew via the Oxygen Generation System (OGS). Marshall is a leader in the development of payload facilities for the ISS. Our innovative EXpedite the PRocessing of Experiments to Space Station (EXPRESS) Rack, provides simple, standard interfaces to accommodate drawer-level, locker, and modular-type payloads from all science disciplines. The EXPRESS Rack concept provides for a simple and shortened integration cycle. By leveraging off of a common avionics design, Marshall has been able to develop derivative payload facilities for other NASA customers, at a reduced cost for the *ISS*. Future *ISS* maintenance costs will be reduced, through the ability to share spare replacement units and repair depots on the common avionics.

In addition, Marshall will provide various types of hardware to carry essential equipment into space. Among these is the Multi-Purpose Logistics Module (MPLM), which will serve as the *ISS* "moving van". The MPLM, loaded with laboratory racks filled with experiments, supplies and equipment, will travel in the Space Shuttle payload bay to dock via the robotic arm to the *ISS*. There, the crew will unload and reload the MPLM to start the process all over

again, giving a quick turnaround to support the *ISS* mission schedule. ASI/Alenia will provide 3 MPLM's (the third is planned for delivery in 2001). MSFC is responsible for engineering oversight of MPLM development, analytical integration for the first flight (planned for 2001), and sustaining engineering of the MPLM modules.

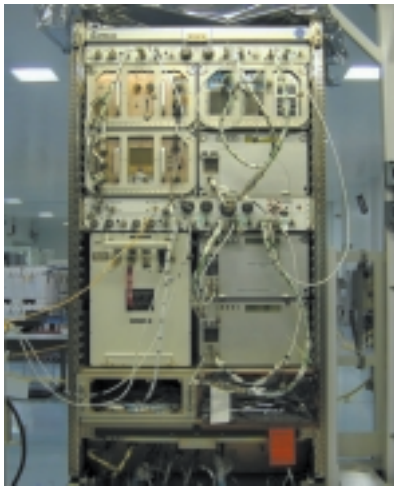
Marshall provides integration support of Spacelab pallets and support equipment for *ISS* assembly. The Payload Carriers Project provides several Spacelab pallets (SLP) and Lightweight Multi-Purpose Experiment Support Structure Carriers (LMC) for use by the *ISS* for assembly and logistics. The SLP is a general-purpose unpressurized carrier that has flown on many Space Shuttle missions since 1983. It is also the optimum carrier for cargo items because it maximizes use of the Shuttle's curved Orbiter Cargo Bay. It also provides the services to make the Shuttle compatible with cargo items. The LMC is under development and will provide a versatile cross-bay carrier to provide payload and cargo accommodations in previously underutilized cargo bay locations. It will fly in the Orbiter's Bay 13, where no carrier has flown before, and over the top of a preinstalled pressurized tunnel.

The Spacelab pallet future is not just limited to *ISS* assembly. Current plans include using two SLP's to support the X–37 experimental vehicle during transport to orbit. The Flight Projects Directorate is responsible for accomplishing the analytical integration required to integrate the payload into the Shuttle. Also, Marshall's Testing, Manufacturing and Support Team (TMAS) will provide technical expertise to *ISS* design and development teams. The areas of hardware design, fabrication, manufacturing, and testing, including structural, dynamic, environmental, electromagnetic, and acoustics, will be supported.

Marshall is also responsible for the management, integration, and execution of payload operations and utilization activities on board the *ISS*. The Payload Operations Integration Center, located at MSFC, is the *ISS* Program focal point for payload operations. MSFC controllers staff the facility and interact with the worldwide scientific research community to plan and conduct payload operations on board the *ISS*. Payload Operations training is a joint effort between MSFC and JSC.

INTERNATIONAL SPACE STATION METRICS

- Complete Spacelab Pallet/Pressurized Mating Adapter-3 mission for *ISS* Flight 3A, STS–92
- Complete Spacelab Pallet/Space Station Remote Manipulator System mission for *ISS* Flight 6A, STS–100
- Complete Spacelab/Oxygen/Nitrogen Tank ORU's mission for *ISS* Flight 7A, STS–104
- Define and negotiate the contract for the USPS development effort
- Deliver the Vapor Compression Distillation (VCD) Flight Experiment to the launch site
- Complete the Critical Design Review (CDR) for the Water Recovery and Oxygen Regeneration Systems
- Deliver the Lightweight Multi Purpose Experiment Support Structure (MPESS) Carrier (LMC) and associated Flight Support Equipment (FSE) to the launch site
- Deliver MPLM Flight Module 3 (FM3) to the launch site
- Provide MSFC certification of flight readiness statements for MPLM FM1 and FM2
- Complete Node 2 primary structure acceptance tests and begin flight unit integration
- Conduct Design Review 2 for Node 2
- Complete development and integration of EXPRESS racks in accordance with flight schedules
- Implement remote payload command and control capabilities for Flight 5A.1
- Conduct integrated payload operations on ISS
- Conduct operational readiness reviews to support ISS flight schedules
- Certify readiness for payload operations in accordance with ISS program schedules in FY01
- Initiate the conduct of ISS remote science operation, supporting the schedule requirements of International Partners and US users



EXPRESS Rack #1 in processing at KSC for *ISS* Flight 6A.

Mock-ups of the two Water Recovery System racks are shown on the left, the Oxygen Generation System rack is on the right.

Flight 3A Spacelab Pallet/Pressurized Mating Adapter-3.

CHANDRA

WE SUPPORT

- Space Science Enterprise

Chandra.

MSFC manages the operation of the MSFC developed Chandra X-ray Observatory through the Operations Control Center and the Chandra X-ray Center at the Smithsonian Astrophysical Observatory in Cambridge, MA. Program goals are to determine the nature of celestial objects from normal stars to quasars, understand the nature of physical processes that take place in and between astronomical objects, and understand the history and evolution of the universe. These goals will be accomplished by extending the range of astrophysical observations significantly beyond that of previous x-ray observatories through increases in sensitivity and resolution.

CHANDRA METRICS

- Fully acceptable performance is defined as instruments meeting nominal performance expectations, completing 80 percent of preplanned and commanded observations with 95 percent of science data recovered on the ground and provided to the observer. Viewing efficiency (time in observing state versus total time) will be greater than 50 percent. Operational lifetime will exceed 5 years with a goal of 10 years.

ADVANCED PROJECTS

WE SUPPORT

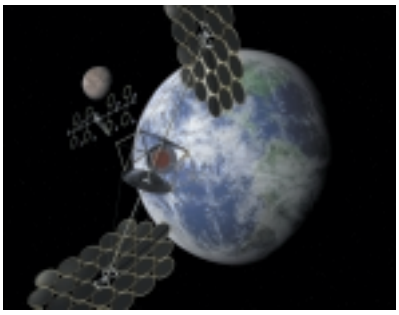
- Human Exploration and Development of Space Enterprise
- Space Science Enterprise Cross-enterprise technologies

The Advance Projects Office manages the Space Solar Power (SSP) Exploratory Research and Technology (SERT) activity, which includes analysis of systems concepts, technology development, and demonstrations, to identify viable approaches to SSP for Earth, planetary surface, and space applications. Products will enable NASA management to make informed decisions on a portfolio of SSP technology investments.

Additional responsibilities include technical support to the NASA next decade planning mission architecture studies for fuel aggregation, and participation and assistance in the management of the HEDS Technology Commercialization Initiative (HTCI).

ADVANCED PROJECTS METRICS

- Provide updates on the SERT activity, including concept analysis, technology roadmaps, and recommendations on near-term technology, research, development and demonstrations
- Demonstrate SSP technologies in solar power generation (SPG), power management and distribution (PMAD), and wireless power transmission (WPT)
- Provide updates on fuel aggregation studies in support of next decade planning studies
- Provide management support and concept definition of applications for space utilities and power in the HTCI including solar power systems and fuel depots in space



Space Solar Power concept from the SERT activity.

New Space Industries could result from HTCI activity.

SPACE SCIENCE RESEARCH

MSFC is designated as a Supporting Center to GSFC for the Space Science Enterprise. Marshall manages the Chandra X-Ray Observatory, Gravity Probe–B (GP–B), Solar–B, Solar X-Ray Imager, and GLAST Burst Monitor (GBM) for Code S.

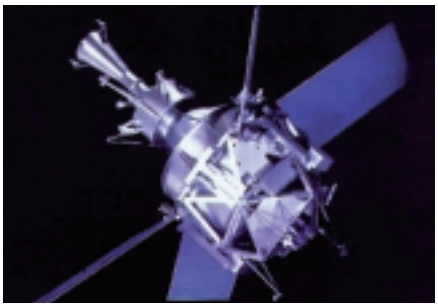
WE SUPPORT

- Space Science Enterprise
- Human Exploration and Development of Space Enterprise
- Aerospace Technology Enterprise

MSFC is responsible for managing the overall design, development integration, test, and flight operations of the Gravity Probe–B (GP–B) flight experiment. The GP–B objective is to test two extraordinary predictions of Einstein's Theory of General Relativity, namely "geodetic precession" and "frame dragging," both of which describe distortions in the space time continuum. In order to test these subtle effects, GP–B will fly ultra-precise gyroscopes aboard a drag-free spacecraft containing the world's largest space-qualified dewar.

MSFC also manages the Solar X-Ray Imager, Solar B and the GLAST Burst Monitor, and conducts fundamental research in six disciplines—cosmic-ray physics, gamma-ray astronomy, x-ray astronomy, solar physics, space plasma physics and astrobiology. In the cosmic- ray field, MSFC scientists are developing and testing particle calorimeters for the Advanced Cosmic Ray Composition Experiment on Space Station (ACCESS). ACCESS will increase the energy range over which the composition and energy spectra of cosmic rays can be measured. In gamma-ray astronomy, MSFC scientists will continue to distribute and analyze data from the Burst and Transient Source Experiment (BATSE) of the Compton Gamma-Ray Observatory. Development has begun on the GLAST Burst Monitor (GBM), which will enhance the capabilities of the Gamma Ray Large Area Space Telescope for observing gamma-ray bursts. Scheduled for launch in 2005, GBM will provide broad spectral coverage and locations for bursts. In x-ray astronomy a balloon payload will be flown to demonstrate a new replicated optics technology being developed for the Constellation-X mission. In solar physics, analysis of MSFC's vector magnetic field measurements in conjunction with data from several U.S. and international space missions will continue. The development of the technology for demonstrating an ultraviolet vector magnetograph has begun. In space plasma physics, data from the TIDE and UVI instruments are being acquired and analyzed as part of the ISTP program. Exciting new data, including imagery, is being acquired, distributed and analyzed from the IMAGE spacecraft.

In astrobiology, MSFC scientists are studying organisms that survive in extreme (hot/cold) conditions to determine which characteristics can serve as biomarkers for probing extraterrestrial samples.



Gravity Probe-B.

SCIENTIFIC PAYLOADS AND RESEARCH METRICS

- Gravity Probe-B
  - Complete final integration and test of the Gravity Probe-B science payload
  - Mission lifetime of 16 months
  - Measurement accuracy for relativistic drift of 0.5 milliarcsecond/year
- Solar-B
  - Mission lifetime of 3 years
  - Engineering models by March 2001
  - Focal plane instrument to ISAS by November 2002
  - Final delivery of XRT by July 2003
- Solar X-Ray Imager
  - Launch on GOES-M no earlier than June 2001
  - Mission lifetime of 3 years
  - Full-disk soft x-ray imaging of the Sun, including solar flares and coronal holes.
- GLAST Burst Monitor
  - Launch in September 2005
  - Mission lifetime of 5 years
  - Detectors delivered by MPE in September 2003
  - Observe gamma ray bursts from 5kev to 30mev

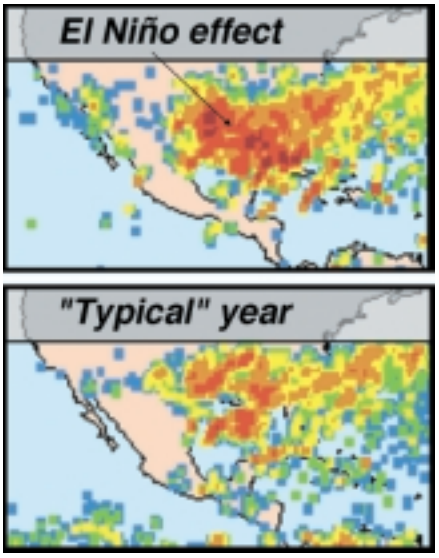
Solar-B.

GLOBAL HYDROLOGY AND CLIMATE CENTER

Climate studies and lightning observations.

WE SUPPORT

- Earth Science Enterprise (ESE)
- National Oceanographic and Atmospheric Administration (NOAA)



Data from LIS showing an increase in convective storms during an El Nino period.

Through the Global Hydrology and Climate Center (GHCC), a joint venture with academia, MSFC engages in research, education, and the development of Earth science applications. The GHCC focuses on using advanced technology to observe and understand the global climate system, and applies this knowledge to agriculture, urban planning, water resource management, and operational meteorology. Areas of emphasis include observations of lightning, winds, and the use of other measurements for the study of Earth's global hydrologic and energy cycles.

FY 2001 GHCC ACTIVITIES

The GHCC will perform global water cycle research emphasizing the use of advanced satellite measurements for determining fundamental atmospheric water variables, their phase, and their three-dimensional transports, translating findings into improved climate prediction models. To emphasize increased accuracy in surface hydrology and dispersion of chemical pollutants, the GHCC will use advanced satellite data assimilation techniques in regional weather prediction models.

A major focus in FY 2001 is strengthening the atmospheric lightning program through continuing research and acquisition of global lightning data from Lighting Imaging Sensor (LIS) onboard the Tropical Rainfall Measurement Mission (TRMM), understanding the relationship between lightning flash rate and severe storm onset, and establishing a collaborative program with NOAA or a commercial entity for acquisition of lightning data from geosynchronous orbit to improve severe storm prediction.

To support archaeological studies and contribute to ESE global land use classification, land use change research in Central America will be performed. In addition, the GHCC will evaluate the interannual climate variability of the southeast U.S. and determine implications on key economic sectors and increase the understanding of sources and sinks for tropospheric ozone and its transport.

Restructure of the coherent wind lidar technology program includes ground-based technology development and data validation, and participation with other centers in planning for future flight opportunities or data purchases. Other activities include developing improved satellite retrieval techniques to measure and monitor atmospheric aerosol concentration, its transport, and its influence on radiative properties of clouds.

Research results from urban heat island studies will be provided to state and local governments for utilization, and the Global Hydrology Resource Center (GHRC) will continue developing its capabilities through component data information systems for LIS, MSU, AMSU, and SSM/I measurements; its ESIP for AMSR data processing; and its efficient accessibility by science community.

The ER2 flies some of the sensors for land and severe storm research.

NATIONAL SPACE SCIENCE AND TECHNOLOGY CENTER

GLOBAL HYDROLOGY AND CLIMATE CENTER METRICS

- Provide demonstration of an improvement to climate modeling or understanding of variability, based upon utilization of satellite data.
- Demonstrate significant improvement in a regional forecast model through the use of geostationary and other satellite data assimilation.
- Continue successful operation of Lightning Mapping Sensor (LIS) on board the Tropical Rainfall Measuring Mission (TRMM).
- Publish 3 scientific papers on the importance of lightning observations in severe storm and/or climate dynamics understanding.
- Assist the University of Alabama in Huntsville (UAH) in developing a plan for a lightning sensor on a geosynchronous satellite for the UnESS program.
- Support development of the Mesoamerican Biological Corridor per NASA/CCAD memorandum of understanding, including development of a JERS-1 SAR mosaic over Central America.
- Foster the application of remote sensing data for analysis of urban landscape change and urban heat island characterization in one to two cities.
- Obtain funding and begin development of a coherent wind lidar ground-based technology test-bed and wind validation facility.
- Fully transition the MSU global temperature monitoring effort to include new AMSU data.
- Successfully implement the AMSR-E Science Investigator-led Processing System (SIPS) upon launch of the Aqua satellite.
- Continue successful operation of the Global Hydrology Resource Center (GHRC), with growth as indicated in the Earth Science Enterprise target goals, and continue in the role as a major contributor to the running and organization of the Federation of ESIPs.

WE SUPPORT

- Earth Science Enterprise (ESE)
- Space Science Enterprise
- Biological and Physical Research Enterprise
- National Scientific Community
  - Academia
  - Industry
  - Government

The National Space Science and Technology Center (NSSTC), headquartered in Huntsville, Alabama, is a research and education institution that provides an environment for selected key scientific disciplines. It consists of researchers and resources from government, academia and industry collaborating in an environment that enables cutting edge basic and applied research and fosters education of the next generation of scientists and engineers. It is a unique blending of people, facilities and tools to encourage advances in Earth Science, Space Science, Biotechnology, Optics and Energy Technology, Propulsion Physics, Materials Science and Information Technology.

The research performed by the NSSTC covers the range of maturity from pure science to technology development to mission operations and data analysis. In appropriate disciplines, laboratory experiments, sounding rockets, balloons and aircraft are used as platforms for the investigations being pursued. Where appropriate, experiments are flown on manned and unmanned spacecraft. Educational activities include both graduate level and undergraduate level for students at the partnering educationa institutions. Partnering educational institutions currently include the University of Alabama, University of Alabama Huntsville (UAH), University of Alabama Birmingham (UAB), Auburn University, Alabama A&M University, and the University of South Alabama.

The NSSTC is a partnership between NASA and the State of Alabama through the Alabama Space Science & Technology Alliance (SSTA) to perform research meeting the nation's needs. The NSSTC is the culmination of the efforts of NASA and the State of Alabama over a two-year period in which NASA invested $9 million and Alabama invested $6.9 million to acquire the core facility for the NSSTC. The University of Alabama in Huntsville, acting as the fiscal agent for the state, procured a facility and executed the renovations. Occupancy of the facility occurred in August 2000 with the move of the Global Hydrology and Climate Center.

NATIONAL SPACE SCIENCE AND TECHNOLOGY CENTER METRICS

- Begin construction of a much-needed annex to house state-of-the-art laboratories.
- Bring in one industry partner to complement the efforts of the research centers
- Bring in one government partner to expand the research capabilities of the research centers.
- Have complete occupancy of the core facility.

AGENCY SUPPORT ACTIVITIES

A broad range of personnel, facility, and operational support services is required to support NASA's mission. NASA Headquarters has assigned the following Agency support activities to MSFC.

PRINCIPAL CENTER SUPPORT ACTIVITIES

- **Communications Architecture and Providing Agency WAN Services**

  Provide an Agencywide communications architecture to support NASA's Enterprises that incorporates flexibility of technologies, efficiency in sustaining costs, and ensures full interoperability through standards.

- **NASA Automated Data Processing Consolidation Center**

  Centrally locate, operate, and manage non-Mission Critical mainframe computers and mid-range systems required to support the Agency's Strategic Enterprises.

- **NASA Digital Television Transition**

  Provide guidelines and lead implementation of High Definition Television (HDTV) capabilities at each NASA field center in accordance with a Space Act Agreement with Dreamtime Holdings, LLC., assuring an efficient transition from NASA's current analog television architecture to the U.S. digital standard.

- **Sustaining Support for Agencywide Administrative Systems**

  Provide the sustaining engineering support to maintain the Agencywide administrative application software and documentation in a current and operational state.

- **NASA Integrated Service Network (NISN)**

  Provide voice, video, data, and messaging services to Agency customers, including mission, center, programmatic, administrative, and scientific communities through the NISN Project Office.

- **NASA Preferred Technical Standards Program**

  In accordance with NASA NPD 8070.6A signed by the Administrator, serves as the Lead Center for the Agency relative to the development, adoption, and data system management for NASA Preferred Technical Standards products and associated standards activities in support of the Agency's Programs/Projects.

- **NASA Acquisition Internet Service (NAIS)**

  Provide the leadership for the Agency's on-line acquisition service and technical support for all operational systems and the primary technical expertise for several developmental projects, including the Virtual Procurement Office (VPO). Responsible for management of Agencywide team.

- **NASA Operational Environment Team (NOET)**

  Provide a continuing capability to support and facilitate activities related to achieving environmental compliance in the design, development, test, use and production of aerospace hardware.

- **National Center for Advanced Manufacturing (NCAM)**

  Enables advanced manufacturing research and technology development and incorporates the use of Intelligent Synthesis Environment into manufacturing to improve the competitiveness of the U.S. aerospace industry.

- **NASA Engineering Infrastructure**

  Lead a NASA-wide effort to define, measure, and improve engineering excellence across the Agency, with focus on people, processes, facilities, and tools.

- **Earned-Value Management (EVM)**

  Establish an effective, value-added NASA EVM program and provide the oversight and guidance for the implementation of EVM policy throughout the Agency.

- **Defense Contract Administrative Service Financial Management Support**

  Maintain system with cost data as well as the Agency-level accounting associated with the Contract Administration and Audit Services provided to NASA from external organizations.

OTHER SUPPORT ACTIVITIES

- ## Integrated Financial Management Program Core Financial Project

  As the first of several potential projects for IFMP, the Core Financial Project will acquire, test, and implement the core financial software at MSFC. Afterwards, the project will lead the effort to implement the system at NASA's other Centers

- ## Integrated Financial Management Program Integration Project

  The IFM Integration Project is responsible for defining, implementing, and maintaining an architecture and infrastructure that provides the integration necessary to accomplish the business objectives of the IFM Program.

- ## Spacelink

  Operate and maintain NASA Spacelink, an electronic aeronautics and space resource that places NASA educational materials, news, and reference data at the fingertips of teachers and students around the world. Managed for the Agency by MSFC since 1988, Spacelink is a fundamental component of NASA's national education dissemination network.

- ## Human Resource and Payroll Information Systems

  Provide leadership in implementing and sustaining an Agency human resource and payroll system that provides the necessary automated tools to professionals that support the NASA workforce. Provides NASA payroll production and customer support for the Agency.

- ## Space Environments and Effects

  Serve as NASA's lead for identifying, developing, and maintaining the technologies required to mitigate effects of hazardous space environments on spacecraft required for future missions.

- ## Logistics Business Systems Operations and Maintenance

  Provide leadership in implementing and sustaining Agency logistics systems that provide the necessary automated tools to professionals that support all NASA Strategic Enterprises, business partners, and logistics business process customers.

- ## Environmental Assessments Impact Statements

  Provide leadership in implementing the National Environmental Policy Act for all new MSFC programs such as X-33, Future X Pathfinders, and Space Solar Power.

- ## AdminSTAR

  Provide leadership in implementing and sustaining a training administration business system across the Agency.

- ## Education Alliances

  Provide leadership and implement a wide-ranging array of programs for the formal and informal education community that are aligned to and support the Agencywide NASA Education Implementation Plan 1999-2003.

INSTITUTIONAL FUNCTIONS AND CAPABILITIES

Our goal: Enhance and sustain a highly skilled, ethical, diverse, and motivated workforce committed to safety while working in a creative and productive environment in support of cutting-edge systems and technology development.

FUNCTIONS	GOALS	METRICS
Center Operations	Revolutionizing customer-driven products and services for mission success. ■ Management Support Office/Contractor Industrial Relations ■ Office of the Chief Information Officer ■ Environmental Engineering Department ■ Facilities Engineering Department ■ Information Services Department ■ Logistics Services Department ■ Protective Services Department ■ Office of Integrated Financial Management Program	■ Maintain 90 percent customer satisfaction. ■ Ensure a minimum 90 percent availability rate for primary mission-related facilities. ■ Maintain, at a minimum, a 95 percent availability rate for all Information Technology services. ■ Initiate and complete transition to web based ordering and one day delivery for all Center administrative supplies. ■ Provide a multi-faceted security education and awareness program to all of the Center workforce to raise awareness of critical asset protection issues and concerns.
Customer and Employee Relations	Facilitate and coordinate the MSFC strategic and implementation planning process and communicate, internally and externally, clear, consistent messages that are traceable to the MSFC Implementation Plan. Partner with other Center organizations to increase collaboration or renew beneficial agreements with government agencies at all levels. Promote alliances with academia, industry, and national and regional associations to utilize ongoing research and technologies developed at the Center. Involve the educational community in our endeavors to inspire students, create learning opportunities aligned with goals established by the educational community, and enlighten inquisitive minds striving to reach underrepresented groups. Provide a staffing and recruitment program that maintains a level of Civil Service FTEs to adequately support Center missions and maintains diversity in the Center's workforce. Conduct a nation-wide recruiting program that seeks out the best and brightest college graduates for the Center's workforce. Incorporate a strategy into the recruiting program to increase the representation of minorities and individuals with disabilities in the Center's workforce. Ensure an effective workforce that enables MSFC to succeed in a dynamic external environment, and provide quality products and services to our customers. ■ Education Programs ■ Employee and Organizational Development ■ Government and Community Relations ■ Human Resources ■ Internal Relations and Communications ■ Media Relations ■ Technology Transfer	■ Maintain the level of Civil Service FTEs to adequately support Center missions while maintaining diversity in the Center's workforce. Achieve greater automation of human resources processes pending sufficient funding from NASA HQ and timely software delivery by the vendor. ■ Enhance public knowledge of MSFC programs and activities by conducting a national media campaign monthly. ■ Develop a regional Educator Resource Center (ERC) network web site which will enhance communication among the ERCs and establish a direct line of communication with MSFC. ■ Pending funding availability, increase the employee and organizational development opportunities by 15 percent over the FY00 baseline. ■ Implement summer program for college undergraduates. ■ Establish 11 new partnerships that compliment Marshall's primary mission areas and leverage the limited resources available to the Center; negotiate 4 new licensing agreements that provide monetary value to the Center and its innovators; release 11 new success stories that highlight the technologies of the Marshall Space Flight Center. ■ Increase the number of key stakeholders briefed on MSFC's roles and missions by 10 percent with a focus on members of Congress on NASA oversight committees. ■ Increase the number of speaking opportunities for the Marshall Director and other Center employees by 10 percent at the local, regional, and national level. ■ Develop and implement a strategic public outreach plan designed to educate key stakeholders and the general public about MSFC roles and missions. The plan would focus on 3 states outside of Alabama. ■ Incorporate a bus tour program that communicates Marshall's mission areas in a high quality and consistent manner. ■ Develop new methods of directing web surfing educators and students to NASA sites containing popular content sought by the educational community.

Equal Opportunity

Promote and strive for equal opportunity; equity and diversity in all occupational groups, grade levels, organizational units; MSFC programs and activities; and fully accessible facilities. Conduct educational programs with historically black and other minority universities.

- Increase workforce representation by 5 percent in underrepresented categories as defined in the Center's current Affirmative Employment Plan, provided MSFC receives hiring authority and a diverse pool of applications are received.
- Improve the accessibility features in five of the Center's buildings and public access areas.
- Increase research participation with historically black and other minority universities by 5 percent, provided appropriate Agency resources are available for FY01.

Financial Management

Serve as stewards of government resources. Develop and maintain processes and systems that ensure accurate financial control across the Center.

- Obligate 95 percent of authorized funding for the current Program Year.
- Cost 70 percent or more of the resources authority available to cost within the fiscal year.
- IFMP—Implement the IFM Core Financial System at MSFC by September 2002..

Legal Support

Support MSFC's assigned roles and missions by providing sound, understandable, timely legal counsel and representation of the highest quality to all MSFC organizational elements. Administer the ethics program and patent prosecution for MSFC.

- Meet all filing deadlines in administrative litigation.
- Review financial disclosure forms within 60 days of submission.

Procurement

Improve effectiveness and efficiency of Center acquisitions through increased use of techniques and management tools that enhance contractor innovations and performance.

- Increase obligated funds available for performance-based contracts to 80 percent
- MSFC will award 20 percent of its dollars available for contracting to Small Business concerns in FY01
- MSFC will award 8 percent of its dollars available for contracting to Small Disadvantaged Businesses in FY01.

Systems Management Office

The Systems Management Office (SMO) provides a focal point for excellence in systems management, including program and project management, systems engineering and cost and economic analysis, for MSFC programs and projects.MSFC SMO Goals include: Lead implementation of MSFC Advanced Engineering Initiative, provide systems management consulting support throughout the product life cycle, provide leadership, consultation services, and technical expertise and determine consistency across product lines for Center systems engineering and cost and economic analysis functions, ensure that MSFC program and project personnel receive training and mentoring in systems engineering and program and project management, ensure that appropriately tailored systems management processes are designed in the formulation of programs/projects, provide independent evaluations of MSFC projects and programs for excellence in project and program management, and support external organizations in reviews, analysis and support of NASA programs and projects. SMO Objectives are to support development of prototype capability for ISE Reusable Space Transportation System application test bed, provide cost and economic assessments of aero-space technology benefits, develop and apply new tools for cost and economic analysis and risk management, develop and implement web-based resources for program and project managers and systems engineers, including best practices and lessons learned, support MSFC implementation of the NASA Engineering Excellence Initiative, leading formulation of systems engineering training plans, plan, conduct and support Independent Assessments and Independent Annual and Non-Advocate Reviews, and support implementation of MPG 2190.1.

- Provide independent cost/economic assessments of 100% of PMC reviewed formulation phase projects above $100M.
- Revise NAFCOM cost model every 18 months to include the latest cost data and model enhancements.
- Expand REDSTAR database by 5% per year.
- Conduct 1-day Systems Engineering/Project Management training courses for 600+ MSFC personnel and provide a four day web-based systems engineering training tool.
- Provide Systems Engineering/Project Management career development processes for 300+ MSFC engineers/managers.
- Conduct Independent Annual Reviews of at least 6 MSFC projects.

ENGINEERING CAPABILITIES

ENGINEERING DIRECTORATE

MSFC's Engineering Directorate provides highly skilled crosscutting engineering services for the MSFC product line directorates and offices, and provides Agency leadership of select crosscutting engineering functions.

Our Vision: "Engineering Excellence Enabling Our Customers' Mission Success"

Our Mission: "In Partnership with our Customers, We Provide Engineering Excellence in Research, Technology, Development and Support, Essential to Mission Success and Safety, and Built upon Our Core Values"

MSFC-ED has Five Core Strategies for implementing the NASA Vision:

Engineering Products & Services
The Engineering Directorate will pursue excellence in providing crosscutting engineering products and services responsive to our customers' needs by utilizing strategic alliances throughout the technical community and providing integrated engineering solutions to enable our customers' mission success.

New Technology Development
The Engineering Directorate will create new and enabling technologies that advance our customers' visions, meet their goals, and enhance U.S. competitiveness.

People
The Engineering Directorate will build a learning organization through professional development to enable a highly qualified and motivated workforce with proper skills and customer focus to achieve mission success.

Infrastructure
The Engineering Directorate will upgrade and maintain the proper infrastructure of facilities, tools, and equipment to assure customer success and enhance our competitive posture.

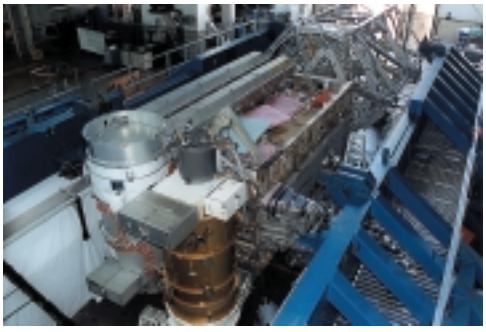
Business
The Engineering Directorate will utilize efficient internal process and effective business practices to integrate with our customers, market our capabilities, and maximize the percentage of resources available to perform engineering work.

The Engineering Directorate provides Integrated Solutions through highly trained and motivated personnel located in Four Departments and Two Offices described below:

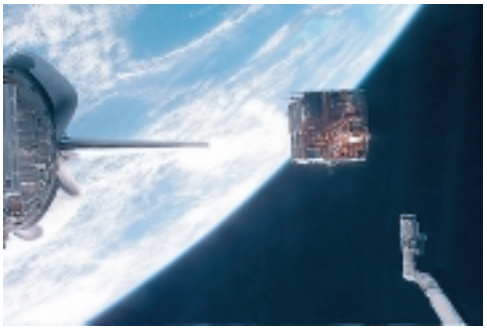
Avionics Department
Plans, performs, and directs R&D in engineering and analysis of electrical systems, guidance and control systems, radio frequency systems, computer and simulation systems, software and avionics simulations systems related to space vehicles, payloads and support equipment.

Structures, Mechanical, and Thermal Department
Plans, conducts, and directs R&D in structural, mechanical, and thermal systems for the analysis, design, and/or qualification testing of space and launch vehicles, payloads, and systems.

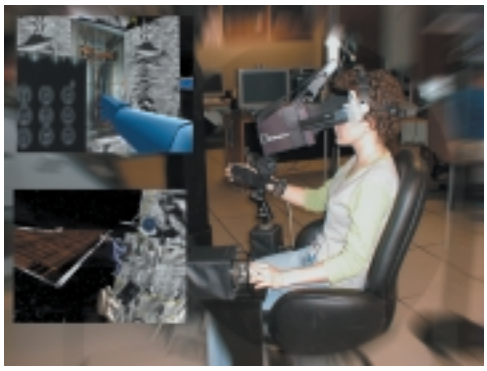
Materials, Processes, and Manufacturing Department
Provides science, technology, and engineering design, development and test of materials, processes, manufacturing technology and products to be used in space vehicle applications, including ground facilities, test articles, and support equipment.



ISS P3/P4 Modal Testing.



On Orbit Demonstration of Automatic Rendezvous and Capture.



Application of Virtual Reality Technology in Space Hardware Design and Operations Analysis.

Hand Lay-up of Multi-bend Feedline.

Engineering Systems Department

Plans and performs systems related cross-cutting engineering services and support encompassing NASA standards, mass properties, kinematics, supportability and logistics, modeling and simulation, human engineering, configuration and data management, and environments (EMI/EMC, space and terrestrials).

Engineering Technology Development Office

Integrates technology development for the directorate and leads the Space Environments and Effects program for the Agency.

Business Management Office

Integrates business management for the directorate and supports Center and Agency-wide initiatives in improving NASA business practices.

The Engineering Directorate seeks to achieve significant improvements in engineering services area in order to be more responsive and customer-focused, integrating its capabilities to achieve customer mission success. The following **Engineering Services Initiatives** are expected to be part of future requirements:

- Maintain customer focus
- Enhance integration of engineering processes across disciplines
- Maintain cognizance of emerging technologies and be fully equipped into development process
- Practice technical accountability and ownership

The Engineering Directorate seeks to focus its people and skill investments for a portion of its portfolio. These are **Technology Thrust Areas** intended to be crosscutting, high impact, and high value investments for ED customers:

- Space Environments and Effects
- Advanced Avionics Architecture
- Advanced Cryogenic Tanks
- Advanced Materials and Structures Applications
- Advanced Manufacturing

ENGINEERING METRICS

- Increase the average hours of training by 10 percent compared to the FY00 baseline.
- Increase in ED membership in professional societies, membership on technical committees and participation in professional conferences by at least 10 percent as compared to the FY00 baseline.
- Increase the number of ED technical publications by 10 percent as compared to the FY00 baseline.
- Increase the number of ED licensed professional engineers by 10 percent as compared to the FY00 baseline.
- Increase the relative number of ED patent disclosures by 20 percent as compared to the FY00 baseline.
- Achieve a score of 90 percent or better for customer satisfaction as determined by ED customer surveys of MSFC product line directorates and offices.
- Establish a minimum of twelve new teaming arrangements with Industry, Academia, other NASA Centers or government Agencies.
- Initiate and/or propose at least one new activity for ED to lead the Agency in a crosscutting engineering function.
- Initiate the transfer of at least two new technologies into the private sector.

POINTS OF CONTACT

For further information regarding the *Marshall Space Flight Center FY 2001 Implementation Plan*, please contact the following individuals.

Center of Excellence for Space Propulsion

Space Transportation Directorate—http://std.msfc.nasa.gov/	TD01	John (Row) Rogacki	256–544–3551
Propulsion Research Center	TD40	Stephen Rodgers	256–544–0818
Space Transportation Engineering	TD50	Helen McConnaughey	256–544–1165
Technology Evaluation Department	TD70	Dennis E. Smith	256–544–9119

Human Exploration and Development of Space

Microgravity Research—http://microgravity.msfc.nasa.gov/	SD10	Robin Henderson	256–544–1738
Flight Projects Directorate—http://flightprojects.msfc.nasa.gov/	FD01	Axel Roth	256–544–0451
Advanced Projects Office—http://flightprojects.msfc.nasa.gov/fd02.html	FD02	Joe Howell	256–544–8491
Space Shuttle—http://liftoff.msfc.nasa.gov/	MP01	Alex McCool	256–544–0718
ISS Propulsion System Project Office	FD50	Linder Metts	256–544–1951
Development Projects Office	TD12	Bob Hughes	256–544–6624

Aerospace Technology

Space Transportation Systems Development—http://stp.msfc.nasa.gov/	TD01	John (Row) Rogacki	256–544–3551
Advanced Space Transportation Program—http://astp.msfc.nasa.gov/	TD15	Garry Lyles	256–544–9203
X–33 Program—http://rlv.msfc.nasa.gov/	TD13	Robert Austin	805–572–2134
Pathfinder Program/X–34/X–37—http://rlv.msfc.nasa.gov/	TD14	John London	256–544–0454
Second Generation Program Office—http://std.msfc.nasa.gov/2ndgen/2ndgenindex.html	TD20	Dan Dumbacher	256–544–0171

Space Science Enterprise

Science Directorate—http://science.nasa.gov	SD01	Frank Rose	256–544–7721
Space Science Department	SD50	Frank Six	256–544–0997
Space Optics Manufacturing Technology	SD70	Scott Smith	256–544–5175
Chandra X-ray Observatory Program Office (CXO)—http://Chandra.nasa.gov/	FD03	Tony Lavoie	256–544–2332
Gravity Probe–B	SD30	Rex Geveden	256–544–9335

Earth Science Enterprise

Global Hydrology and Climate Center (GHCC) http://www.ghcc.msfc.nasa.gov/ghcc_home.html	SD60	Jim Arnold	256–922–5722

Principal Center and Agency Support Activities

NASA Payroll Operations Consolidation	RS10	Mike Clemons	256–544–7345
NASA Human Resources Systems	CD02	Lou Nosenzo	256–544–7401
Integrated Financial Management ProgramCore Financial Projects	RS02	Pam Cucarola	256–544–7281

Integrated Financial Management Program Integration Progect	AD04	Jonathan Pettus	256–544–9271
Communications Architecture and Providing Agency WAN Services	AD33	Terry Luttrell	256–544–0130
NASA Automated Data Processing Consolidation Center	AD31	Portia Dischinger	256–544–8650
Earned Value Performance Management	RS40	Frank Hicks	256–544–5389
NASA Preferred Technical Standards Program	ED40	Paul Gill	256–544–2557
Space Environments and Effects	ED03	Billy Kaufmann	256–544–1418
NASA Digital Television Transition	AD32	Rodney Grubbs	256–544–4582
Sustaining Engineering Support for Agencywide Administrative Systems	AD33	Sheila Fogle	256–544–5638
Logistics Business Systems Operations and Maintenance	AD40	Nikita Zurkin	256–544–6326
AdminSTAR	CD02	Lisa Martin	256–544–4376
NASA Operational Environment Team	ED36	Dennis Griffin	256–544–2493
Defense Contract Administrative Service Financial Management Support	RS21	Lee Harp	256–544–7271
NASA Integrated Service Network	AD30	Rick Helmick	256–544–3460
National Center for Advanced Manufacturing	ED34	Corky Clinton	256–544–2682
Spacelink—http://spacelink.nasa.gov	CD60	Jeff Ehmen	256–544–6531
NASA Acquisition Internet Service (NAIS)	PS10	Jim Bradford	256–544–0306
Environmental Assessments Impact Statements	AD10	Rebecca McCaleb	256–544–4367

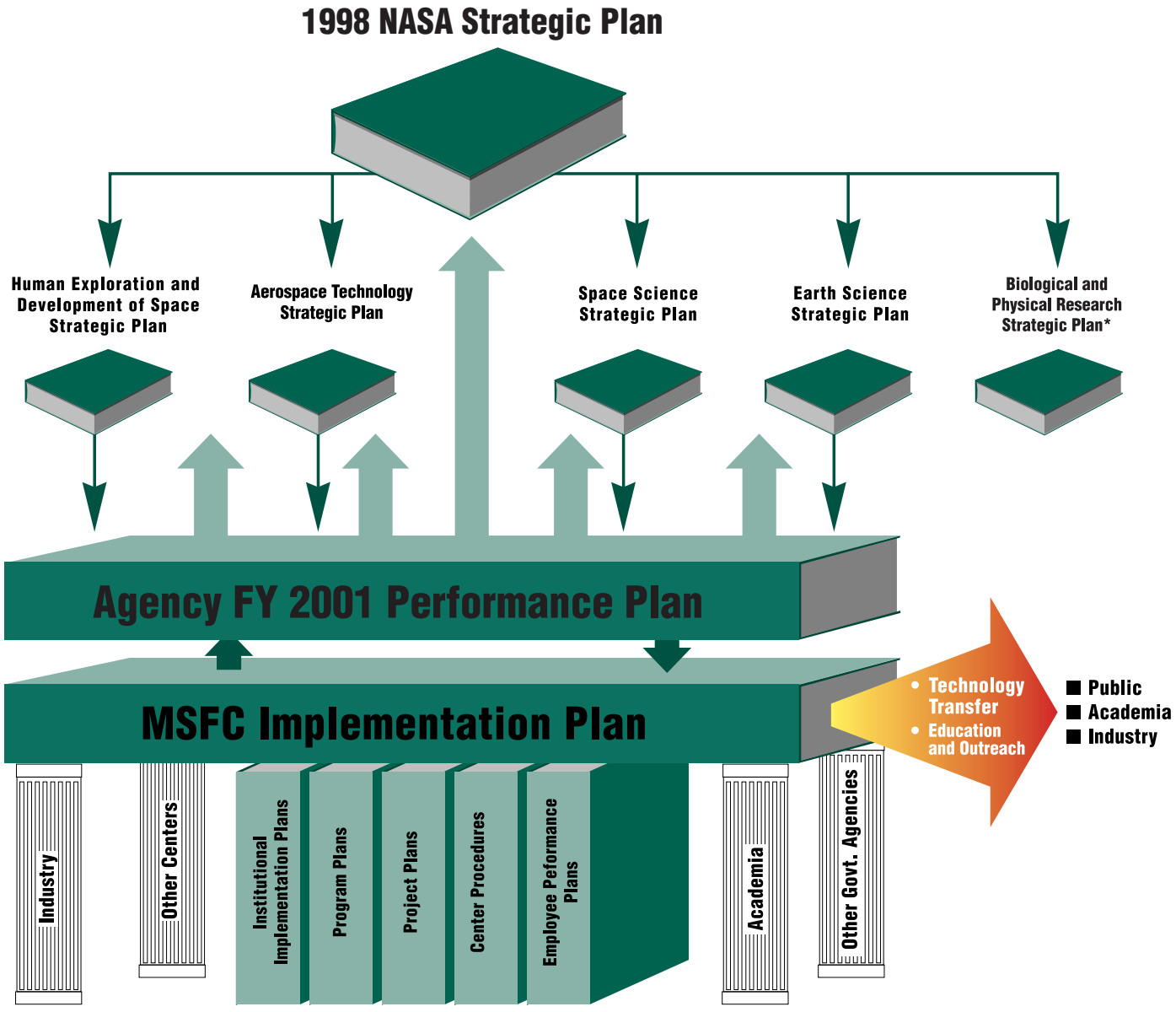
MSFC Institutional Functions and Capabilities—http://www.msfc.nasa.gov/

Engineering Directorate	ED01	Jim Kennedy	256–544–1000
Chief Counsel	LS01	Bill Hicks	256–544–0010
Chief Information Officer	AD03	Sheila Cloud	256–544–0120
Customer and Employee Relations	CD01	Tereasa Washington	256–544–7491
Educational Programs	CD60	Jim Pruitt	256–544–8800
Equal Opportunity	OS01	Charles Scales	256–544–4927
Financial Management	RS01	David Bates	256–544–0092
Human Resources	CD10	Danny Hightower	256–544–7496
Internal Relations & Communications	CD40	Robert Champion	256–544–0478
Government & Community Relations	CD50	Shar Hendrick	256–544–5549
Employee and Organizational Development	CD20	Greg Walker	256–544–7558
Information Services	AD30	Rick Helmick	256–544–3460
Facilities Engineering	AD20	Peter Allen	256–544–7909
Environmental Engineering	AD10	Rebecca McCaleb	256–544–4367
Logistics Services	AD40	Roy Malone	256–544–0506
Procurement	PS01	Steve Beale	256–544–0257
Safety & Mission Assurance	QS01	Amanda Goodson	256–544–0043
Technology Transfer	CD30	Sally Little	256–544–4266
Protective Services	AD50	Bradley Waits	256–544–4534
Media Relations	CD70	Dom Amatore	256–544–0031
Systems Management Office	VS01	Robert McBrayer	256–544–1926
Occupational Safety	QS10	Herb Shivers	256–544–8903
Occupational Health	AD02M	William Dye	256–544–2390

MSFC'S LINK TO THE FUTURE

The *NASA Strategic Plan* defines the Agency's vision, mission, and fundamental questions of science and research that provide the foundation for our goals. The Strategic Enterprises identify their objectives to meet the Agency's goals in their individual Strategic Plans.

The *MSFC FY 2001 Implementation Plan* provides the link for the Center Program Plans, Project Plans, Institutional Implementation Plans, Center Procedures, and Employee Performance Plans to the Agency and Enterprise Strategic Plans. Our implementation is supported by industry, other Centers, other Federal agencies, and academia. The Implementation Plan reflects MSFC's dedication to NASA's goals and communicates to the Strategic Enterprises, our employees, and our partners and customers the implementation of our roles and missions through metrics tied to the Agency budget.



*The requirements of the newly established Enterprise will be included in the next fiscal year's Agency Performance Plan and Center Implementation Plan.

IMPLEMENTATION PLAN LINKAGE TO THE FY 2001 NASA PERFORMANCE PLAN

Human Exploration and Development of Space Enterprise

NASA Near-Term Goals	NASA Objectives	NASA Performance Targets	MSFC Implementation	FY 2001 MSFC Metrics
Expand the Space Frontier	Define innovative human exploration mission approaches	Complete initial next decade planning mission architecture studies.	Support the next decade planning mission architecture studies for fuel aggregation and other activities as requested.	Provide updates on fuel aggregation studies in support of next decade planning studies
	Invest in enabling high-leverage technologies	Initiate the HEDS Technology/ Commercialization program and establish a synergistic relationship with industry	Participate and assist in the management of the HEDS Technology Commercialization Initiative (HTCI) as needed.	Provide management support and concept definition of applications for the space utilities and power for the HTCI including solar power systems and fuel depots in space
Enable and establish a permanent and productive human presence in Earth orbit.	Deploy and use the ISS to advance scientific exploration, engineering, and commercial objectives	Successfully complete the majority of the ISS planned on-orbit activities such as delivery of mass to orbit and enhanced functionally.	Continue successful execution of assigned hardware development, project engineering and integration, supporting development, and sustaining engineering tasks.	Deliver the Vapor Compression Distillation (VCD) Flight Experiment to the launch site Complete the Critical Design Review (CDR) for the Water Recovery and Oxygen Regeneration Systems Deliver the Lightweight Multi Purpose Experiment Support Structure (MPESS) Carrier (LMC) and associated Flight Support Equipment (FSE) to the launch site Deliver MPLM Flight Module 3 (FM3) to the launch site Provide MSFC certification of flight readiness statements for MPLM FM1 and FM2 Complete Node 2 primary structure acceptance tests and begin flight unit integration Conduct Design Review 2 for Node 2 Baseline U.S. Propulsion System (USPS) Requirements for the *ISS* Define and negotiate the contract for the USPS development effort Complete Spacelab Pallet/Pressurized Mating Adapter-3 mission for *ISS* Flight 3A, STS-92 Complete Spacelab Pallet/Space Station Remote Manipulator System mission for *ISS* Flight 6A, STS-100 Complete Spacelab/Oxygen/Nitrogen Tank ORU's mission for *ISS* Flight 7A, STS-104
			Deliver the EXPRESS integrated trainer rack to the space station training facility to support integrated crew training	Complete development and integration of EXPRESS racks in accordance with flight schedules
			Complete preparations for the initial ISS research capability	Implement remote payload command and control capabilities for Flight 5A.1
			Conduct payload operations, integrating remote US science users and International Partners	Meet all increment readiness CoFR milestones with certified readiness of HOSC equipment and ground support personnel Begin remote operation, and deliver ground system remote ops enhancements
	Provide safe and affordable access to space.	Achieve 8 or fewer flight anomalies per mission.	MSFC Space Shuttle Projects Office	Maintain less than 1 in-flight anomaly (IFA) per mission for MSFC related propulsion elements.

Human Exploration and Development of Space Enterprise (continued)

NASA Near-Term Goals	NASA Objectives	NASA Performance Targets	MSFC Implementation	FY 2001 MSFC Metrics
	Provide safe and affordable access to space.	The Office of Space Flight will expedite a safety improvement program to ensure the continued safe operations of the Space Shuttle that ensures the availability of a safe and reliable Shuttle system to support Space Station Assembly milestones and operations.	MSFC Space Shuttle Projects Office	Enhance safety, assure Mission Supportability and sustain the life of the Shuttle. To improve the reliability of the Space Shuttle Propulsion System upgrades, such as the following, are to be incorporated: External Tank Friction Stir Welding, Space Shuttle Main Engine Advanced Health Management, Reusable Solid Rocket Motor Propellant Grain Geometry Modification, Solid Rocket Booster Advanced Thrust Vector Control (ATVC). Meet the Manifest and Improve Mission Supportability through Robust Processes, Process Control, and Production Process Efficiency. No delays in the Shuttle flight manifest will be attributable to MSFC Shuttle propulsion elements.
Expand Scientific Knowledge	In partnership with the scientific community, use the space environment to investigate chemical, biological, and physical systems.	Support an expanded, productive research community to include 975 investigations by 2001.	MSFC Microgravity Research	Support at least 450 Investigations. Support at least 10 Science Concept Reviews and 15 Requirements Definition Reviews. Conduct at least 12 KC-135 flight campaigns to produce selected science and engineering data. Conduct 2 sub-orbital sounding rocket flights. Conduct goal directed workshop to define methods, databases, and validating tests for material flammability characterization, hazard reduction, and fire detection/ suppression strategies for spacecraft and extraterrestrial habitats.
			Materials Science Research	Deliver 4 Science Concept Reviews Deliver 6 Requirements Definition Reviews Releasing Materials Science 2000 NASA Research Announcements
			Molecular Biotechnology	Fully implement the recommendations of the National Research Council. Develop and implement a method to radically accelerate the time between idea and data recovery for scientists desiring to perform Structural Biology experiments in low gravity. Identify, form partnerships, and perform exploratory experimentation in biomaterials and nanotechnology to support NASA goals in Bioastronautics and Astrobiology.
		Begin research on the International Space Station	MSFC Microgravity Research	Conduct Biotechnology, Fluid Physics and small multi-discipline investigations on the *ISS* according to the U.S. Partner Utilization Plan. Use the rotating bioreactor to model microgravity for microbes and mammalian cells to identify potential parameters.
			Microgravity Science & Applications Glovebox Program	Deliver the Microgravity Science Glovebox Facility to ISS for the UF1 flight. Deliver the vibration isolation system Glovebox Integrated Microgravity Isolation Technology (g-LIMIT) to *ISS* for the UF1 flight. Integrate 3 experiments into MSG for UF-1 Flight

Human Exploration and Development of Space Enterprise (continued)

NASA Near-Term Goals	NASA Objectives	NASA Performance Targets	MSFC Implementation	FY 2001 MSFC Metrics
Expand the commercial development of space	Facilitate access to space for commercial researchers	Establish at least ten new, active industrial partnerships to research tomorrow's space products and improve industrial processes through NASA's Commercial Centers and find opportunities for space experiments.	MSFC Space Product Development	Provide policies and resources to enable at least 10 new active industrial partnerships to be established with the Space Product Development Commercial Space Centers.
	Foster commercial participation on the *ISS*	Foster commercial endeavors by reviewing and/or implementing new policies and plans, such as the Space Station resource pricing policy and intellectual property rights policy. Ensure that ISS resources allocated to commercial research are utilized by commercial partners to develop commercial products and improve industrial processes.	MSFC Space Product Development	Provide leadership and support to assure that all Space Product Development payloads meet ground and flight safety requirements. Review Annual Report, recommend and implement additions or changes for FY 2001 report. Support at least four industrial conferences with Space Product Development displays and information booths. Initiate review of all Space Product Development Commercial Space Centers using criteria based on established policies and operating principles.
Share the experience and discovery of human space flight	Increase the scientific, technological, and academic achievement of the nation by sharing our knowledge, capabilities, and assets.	Support participation in HEDS research.	MSFC Space Product Development	Provide policies and resources to enable at least 50 undergraduate and graduate students to participate in commercial space flight and technologies research.
Cross-cutting target		Improve health of the NASA workforce	MSFC Shuttle Projects Office	WORK FORCE SAFETY: Conduct the following Safety Initiatives to insure a safe workplace environment. Monthly Area Walkthroughs & Documentation Monthly Project Safety Meetings. Maintain safety performance records at our contractor facilites which exceed industry standards.
Enable and establish a permanent and productive human presence in Earth orbit.	Deploy and use the *ISS* to advance scientific exploration, engineering, and commercial objectives	Successfully complete the majority of the combined *ISS* planned operations schedules and milestones as represented by permanent human on-orbit operations.	Certify cadre for integrated payload operations and deliver associated flight products	Conduct integrated payload operations on *ISS*
			Deliver ground support systems for payload operations	Conduct operational readiness reviews to support *ISS* flight schedules

Aerospace Technology Enterprise

NASA Near-Term Goals	NASA Objectives	NASA Performance Targets	MSFC Implementation	FY 2001 MSFC Metrics
Space Transportation	Reduce the cost of interorbital transfer and travel time for planetary missions	NASA's research stresses technology for reusable, long- life, high- power electric and advanced, clean chemical engines for Earth orbital transfer and breakthrough propulsion, precision landing systems and aerocapture systems for planetary exploration. This is required to support the objective of reducing the cost of interorbital transfer by an order of magnitude and travel time for planetary missions by a factor of two within 15 years.	Space propulsion initiatives	Fly ProSEDS Tether propulsion flight experiment Complete Propulsion Research Laboratory (PRL) engineering study; initiate PRL design effort Complete X-38 De-Orbit Propulsion System hardware integration
	Reduce the payload cost to low-Earth-orbit	NASA's research stresses highly reliable, fully reusable configurations, advanced materials and innovative structures to support the objective of reducing the payload cost to low-Earth orbit by an order of magnitude within 10 years, and an additional order of magnitude within 25 years.	Management of ASTP	Complete X–40A approach and landing test series Conduct post-flight analysis of SHARP-B2 flight experiment Complete validation of polymer matrix composite cryogenic LH2 and LOX tanks including: – Compatible materials systems and processes – Fabrication and joining technology for large-scale articles – Demonstrated thermal performance Complete Systems Requirements Review (SRR) for RBCC Demonstrator Engine Complete competitive solicitations and award multiple industry contracts for 2nd-Generation RLV Requirements Definition and Risk Reduction Effort Release RFP, perform evaluations and negotiate contract for NGLS Complete and review results of Alternate Access Study contracts; release follow-on RFP Complete Dual Engine testing for X–33 flight engines Complete design of X–33 metallic LH2 tanks Complete X–34 captive-carry testing Conduct initial, unpowered flight of X–34 Complete initial X–34 unlined composite LOX tank test series Conduct integrated X–34 propulsion testing with MC-1 engine Complete X–37 design

Space Science Enterprise

NASA Near-Term Goals	NASA Objectives	NASA Performance Targets	MSFC Implementation	FY 2001 MSFC Metrics
Chart the evolution of the universe, from origins to destiny, and understand its galaxies, stars, planets, and life	Solve mysteries of the universe	Obtain scientific data from 80% of operating missions	Management of the Chandra program	Fully acceptable performance is defined as instruments meeting nominal performance expectations, completing 80 percent of preplanned and commanded observations with 95 percent of science data recovered on the ground and provided to the observer. Viewing efficiency (time in observing state versus total time) will be greater than 50 percent. Operational lifetime will exceed 5 years with a goal of 10 years.
		Perform innovative scientific research and technology development, by meeting technology development objectives for major projects, by undertaking astronomy rocket and balloon flights, and by making satisfactory research progress in related Research and Analysis (R&A) and Data Analysis (DA) programs	Space Science Research programs	Gravity Probe-B – Complete final integration and test of the Gravity Probe-B science payload – Mission lifetime of 16 months – Measurement accuracy for relativistic drift of 0.5 milliarcsecond/year Solar-B – Mission lifetime of 3 years – Engineering models by March 2001 – Focal plane instrument to ISAS by November 2002 – Final delivery of XRT by July 2003 Solar X-Ray Imager – Launch on GOES-M no earlier than June 2001 – Mission lifetime of 3 years – Full-disk soft x-ray imaging of the Sun, including solar flares and coronal holes. GLAST Burst Monitor – Launch in September 2005 – Mission lifetime of 5 years – Detectors delivered by MPE in September 2003 – Observe gamma ray bursts from 5kev to 30mev
Develop new technologies needed to carry out innovative and less costly mission and research concepts	Develop new technologies needed to carry out innovative and less costly mission and research concepts	Plan, develop, and validate new technologies needed to enable future research and flight missions by achieving performance objectives in the space science core technology programs	MSFC advanced projects	Provide updates on the SERT activity, including concept analysis, technology roadmaps, and recommendations on near-term technology, research, development and demonstrations Demonstrate SSP technologies in solar power generation (SPG), power management and distribution (PMAD), and wireless power transmission (WPT) Provide updates on fuel aggregation studies in support of next decade planning studies Provide management support and concept definition of applications for space utilities and power in the HTCI including solar power systems and fuel depots in space

Space Science Enterprise (continued)

NASA Near-Term Goals	NASA Objectives	NASA Performance Targets	MSFC Implementation	FY 2001 MSFC Metrics
Develop new technologies needed to carry out innovative and less costly mission and research concepts	Develop new technologies needed to carry out innovative and less costly mission and research concepts	Plan, develop, and validate new technologies needed to enable future research and flight missions by achieving performance objectives in the space science core technology programs	Space Optics Manufacturing Technology	Produce a solar collector quality mirror with areal density of <0.1 kg/m^2 Complete the installation of the inductive edge sensors on a segmented ground-based telescope. Produce 0.5-meter diameter replicated optic of optical quality and <1.0 kg/m^2. For NGST, test two additional mirror technologies as the suppliers deliver them. For Constellation X-ray, continue improvement of the resolution by a factor of 2. Implement continued process improvements in the XRCF to reduce the cost of testing by an additional 5%. Install the additional single point diamond turning machine. Establish a financially self-sufficient group within two years. Demonstrate 4-fold efficiency increase for solar pumped laser. Define a 2-10 megawatt Solar Electric Propulsion system for outer planet exploration using derived Space Solar Power technology. Develop and demonstrate neuro-fuzzy logic controller for active segmented optics.
Contribute to achieve the science, math, and technology education goals of our nation.	Make education and enhance public understanding of science an integral part of our missions and research.	Continue to expand the integration of education and enhanced public understanding of science with Enterprise research and flight mission programs.	MSFC Science Communicartions Process	Double the number of visitors to MSFC Science web pages.

Earth Science Enterprise

NASA Near-Term Goals	NASA Objectives	NASA Performance Targets	MSFC Implementation	FY 2001 MSFC Metrics
Expand scientific knowledge by characterizing the Earth system	Successfully launch spacecraft	Successfully develop, have ready for launch, and operate instruments on at least two spacecraft to enable Earth Science research and applications goals and objectives. Refers to two spacecraft for entire Agency per year.	Global Hydrology and Climate Center activities	Demonstrate significant improvement in a regional forecast model through the use of geostationary and other satellite data assimilation. Continue successful operation of Lightning Mapping Sensor (LIS) on board the Tropical Rainfall Measuring Mission (TRMM). Successfully implement the AMSR-E Science Investigator-led Processing System (SIPS) upon launch of the Aqua satellite.
Dissemintate information about the Earth system	Implement responsive data system architechture	Successfully disseminate Earth Science data to enable our science research and applications goals and objectives	Global Hydrology and Climate Center activities	Publish 3 scientific papers on the importance of lightning observations in severe storm and/or climate dynamics understanding. Assist the University of Alabama in Huntsville (UAH) in developing a plan for a lightning sensor on a geosynchronous satellite for the UnESS program. Support development of the Mesoamerican Biological Corridor per NASA/CCAD memorandum of understanding, including development of a JERS-1 SAR mosaic over Central America. Fully transition the MSU global temperature monitoring effort to include new AMSU data. Continue successful operation of the Global Hydrology Resource Center (GHRC), with growth as indicated in the Earth Science Enterprise target goals, and continue in the role as a major contributor to the running and organization of the Federation of ESIPs.
Expand scientific knowledge by characterizing the Earth system	Understand causes and consequences of land-cover/land-use change	Explore the dynamics of global water cycle by developing, analyzing, and documenting multi-year data sets	Global Hydrology and Climate Center activities	Provide demonstration of an improvement to climate modeling or understanding of variability, based upon utilization of satellite data.
Enable productive use of ESE science and technology in the public and private sectors	Extend the use of Earth Science research to regional, state, and local applications	Provide regional decision-makers with scientific and applications products/tools	Global Hydrology and Climate Center activities	Obtain funding and begin development of a coherent wind lidar ground-based technology test-bed and wind validation facility.
		Improve access to and understanding of remotely sensed data and processing technology	Global Hydrology and Climate Center activities	Foster the application of remote sensing data for analysis of urban landscape change and urban heat island characterization in one to two cities.

Manage Strategically

NASA Near-Term Goals	NASA Objectives	NASA Performance Targets	MSFC Implementation	FY 2001 MSFC Metrics
Ensure the Agency meets its responsibilities effectively and safely, as it allocates its resources to support NASA's Strategic, Implementation, and Performance Plans	Assess, document, communicate, and mitigate the risk associated with NASA programs and projects	NASA will increase the safety of its infrastructure and workforce with facilities safety improvements, reduced environmental hazards, increased physical security, and enhanced safety awareness among its employees	Safety and Mission Assurance Office	Achieve a world class lost-time mishap rate of 0.1 or less with the ultimate goal of 0 All MSFC projects successfully complete their safety reviews on time
			Systems Management Office	Provide independent cost/economic assessments of 100% of PMC reviewed formulation phase projects above $100M. Revise NAFCOM cost model every 18 months to include the latest cost data and model enhancements. Expand REDSTAR database by 5% per year. Conduct Independent Annual Reviews of at least 6 MSFC projects
	Improve the effectiveness and efficiency of Agency acquisitions through the increased use of techniques and management that enhance contractor innovations and performance	Continue to take advantage of opportunities for improved contract management by maintaining a high proportion of Performance Based Contracts (PBC's), and maintain significant contractor involvement in NASA programs for small businesses, minority institutions, and minority and women owned businesses	Procurement Office	Increase obligated funds available for performance-based contracts to 80 percent MSFC will award 20 percent of its dollars available for contracting to Small Business concerns in FY01 MSFC will award 8 percent of its dollars available for contracting to Small Disadvantaged Businesses in FY01.
	Optimize investment strategies and systems to align human, physical, and financial resources with customer requirements, while ensuring compliance with applicable statues and regulations	Renew Agency's management systems, facilities, and human resources through updated use of automated systems, facilities revitalization, and personnel training	Center Operations Directorate	Maintain 90 percent customer satisfaction. Ensure a minimum 90 percent availability rate for primary mission-related facilities. Maintain, at a minimum, a 95 percent availability rate for all Information Technology services. Initiate and complete transition to web based ordering and one day delivery for all Center administrative supplies. Provide a multi-faceted security education and awareness program to all of the Center workforce to raise awareness of critical asset protection issues and concerns.
			Human Resources Department	Maintain the level of Civil Service FTEs to adequately support Center missions while maintaining diversity in the Center's workforce. Achieve greater automation of human resources processes.
			Employee Organizational Development Department	Increase the employee and organizational development opportunities by 15 percent over the FY00 baseline.
			Equal Opportunity Office	Increase workforce representation by 5 percent in underrepresented categories as defined in the Center's current Affirmative Employment Plan Improve the accessability features in five of the Center's buildings and public access areas Increase research participation with historically black and other minority universities by 5 percent.
			Legal Support	Meet all filing deadlines in administrative litigation. Review financial disclosure forms within 60 days of submission.

Manage Strategically (Continued)

NASA Near-Term Goals	NASA Objectives	NASA Performance Targets	MSFC Implementation	FY 2001 MSFC Metrics
			Financial Management Office	Obligate 95 percent of authorized funding for the current Program Year. Cost 70 percent or more of the resources authority available to cost within the fiscal year. IFMP—Implement the IFM Core Financial System at MSFC by September 2002.

Provide Aerospace Products and Capabilities

NASA Near-Term Goals	NASA Objectives	NASA Performance Targets	MSFC Implementation	FY 2001 MSFC Metrics
Enable NASA's Strategic Enterprises and their Centers to deliver products and services to customers more effectively and efficiently while extending the technology, research, and science benefits broadly to the public and commercial sectors	Reduce the cost and development time to deliver products and operational services	Meet schedule and cost commitments by keeping the development and upgrade of major scientific facilities and capital assets within 110% of cost and schedule estimates, on average	Systems Management Office	Conduct 1-day Systems Engineering/ Project Management training courses for 600+ MSFC personnel and provide a four day web-based systems engineering tool. Provide Systems Engineering/Project Management career development processes for 300+ MSFC engineers/managers.
	Improve and maintain NASA's engineering capability	Establish prototype engineering environments	Engineering Directorate	Increase the average hours of training by 10 percent compared to the FY00 baseline. Increase the number of ED licensed professional engineers by 10 percent as compared to the FY00 baseline. Achieve a score of 90 percent or better for customer satisfaction as determined by ED customer surveys of MSFC product line directorates and offices.
	Facilitate the insertion of technology into all programs and proactively transfer technology to strengthen U.S. competitiveness	Dedicate the percentage of the technology budget reported in the FY00 Performance Report toward leveraging with activities of other organizations	Engineering Directorate	Increase in ED membership in professional societies, membership on technical committees and participation in professional conferences by at least 10 percent as compared to the FY00 baseline. Increase the number of ED technical publications by 10 percent as compared to the FY00 baseline. Increase the relative number of ED patent disclosures by 20 percent as compared to the FY00 baseline. Initiate and/or propose at least one new activity for ED to lead the Agency in a crosscutting engineering function. Initiate the transfer of at least two new technologies into the private sector.
		Dedicate 10 to 20 percent of the Agency's R&D Budget to commercial partnerships	Technology Transfer Department	Establish 11 new partnerships that compliment Marshall's primary mission areas and leverage the limited resources available to the Center.

Generate Knowledge

NASA Near-Term Goals	NASA Objectives	NASA Performance Targets	MSFC Implementation	FY 2001 MSFC Metrics
Extend the boundaries of knowledge of science and engineering, capture new knowledge in useful and transferable media, and share new knowledge with customers	Collaborate with old and new partners	Work with other federal agencies and U.S. industry to complement and support our activities	Engineering Directorate	Establish a minimum of twelve new teaming arrangements with Industry, Academia, other NASA Centers or government Agencies.
			Technology Transfer Department	Negotiate 4 new licensing agreements that provide monetary value to the Center and its innovators.
			National Space Science and Technology Center	Begin construction of a much-needed annex to house state-of-the-art labs Bring in one industry partner to complement the efforts of the research centers Bring in one government partner to expand the research capabilities of the research centers. Have complete occupancy of the core facility.

Communicate Knowledge

NASA Near-Term Goals	NASA Objectives	NASA Performance Targets	MSFC Implementation	FY 2001 MSFC Metrics
Ensure that NASA's customers receive the information derived from NASA's research efforts that they want, in the format they want, for as long as they want it	Highlight existing and identify new opportunities for NASA's customers, including the public, the academic community, and the nation's students, to participate directly in space research and discovery Improve the external constituent communities' knowledge, understanding, and use of results and opportunities associated with NASA's programs	Convey information about, and knowledge generated by NASA's programs, to the public	Media Relations Department	Enhance public knowledge of MSFC programs and activities by conducting a national media campaign monthly.
			Government and Community Relations Department	Increase the number of key stakeholders briefed on MSFC's roles and missions by 10 percent with a focus on members of Congress on NASA oversight committees. Increase the number of speaking opportunities for the Marshall Director and other Center employees by 10 percent at the local, regional, and national level. Develop and implement a strategic public outreach plan designed to educate key stakeholders and the general public about MSFC roles and missions. The plan would focus on 3 states outside of Alabama. Incorporate a bus tour program that communicates Marshall's mission areas in a high quality and consistent manner.
			MSFC Science Communications Process	Double the number of visitors to MSFC Science web pages.
		Facilitate the transfer of NASA generated technology and innovations to private industry	Technology Transfer Department	Release 11 new success stories that highlight the technologies of the Marshall Space Flight Center.
		Support educational excellence and reach out to the underserved and underrepresented minority community	Education Programs	Develop new methods of directing web surfing educators and students to NASA sites containing popular content sought by the educational community. Develop a regional Educator Resource Center (ERC) network web site which will enhance communication among the ERCs and establish a direct line of communication with MSFC. Implement summer program for college undergraduates.

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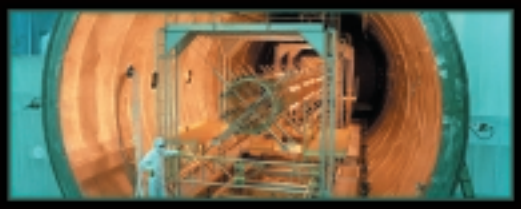

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